Unimelb for Palestine (UM4P)

A non-affiliated grassroots collective of University of Melbourne students, staff, and alumni organising on campus for a Free Palestine.

EXPOSÉ REPORT

No. 1 2024

Unimelb's Complicity in Genocide: Ties to Weapons Manufacturers

Summary

The hypermilitarisation of Australian Universities is a concerning trend that risks the future of the University as we know it and the values that underpin this public institution. The University of Melbourne's response to and complicity in the unfolding genocide in Palestine is an example of what research partnerships with the defence industry could mean for academic freedoms and the challenges facing educational institution. The hypermilitiarisaton trend is occurring at the same time the University claims to be committed to cultural diversity, anti-racism and reconciliation efforts with indigenous communities. The University remains as an institution on stolen land and with a fork

tongue has competing visions on its commitments to addressing its colonial past. Its militarisation of campus stands in opposition to its stated anti-racism commitments and has only magnified the ongoing effects of colonisation including racism on campus for Indigenous people, Palestinian students and staff, and their supporters. This report details the University of Melbourne's research partnerships with weapons manufacturers with the purpose to highlight that public educational institutions producing research with money from companies that profit from war is an unethical practice, even if such research is for non-military use. The report demonstrates how these partnerships are institutional collusion with the war industry. The Unimelb for Palestine (UM4P) calls for the end to any partnership, collaboration, now and in the future, with the defence industry. The University cannot claim to be committed to staff and student wellbeing, and its anti-racism and reconciliation efforts, when it is simultaneously committed to facilitating genocide and profiting from the war industry.

Introduction

The University of Melbourne (Unimelb) has numerous collaborations with defence agencies and weapons manufacturers, including, but not limited to, Lockheed Martin, Boeing, BAE Systems, Leonardo and IBM. Many of these weapons companies are directly linked to weapons being used in Israel's ongoing genocide against Palestinians. While Unimelb participates in research with these companies, their weapons are being used in the epistemicide and scholasticide oft Palestinian universities, academics, and students.

The University of Melbourne claims to pride itself on being a public university that champions ethical research and anti-racism, diversity and inclusion, and reconciliation. Collaborations with weapons manufacturers in any capacity should be fundamentally incompatible with these claims. This unethical research is not just a moral failure, but the University is also not upholding its legal requirement to protect the safety of all community members, least not Palestinian and pro-Palestinian supporters experiencing harassment for voicing their concerns against a clearly documented genocide.

Further, Unimelb has always been a colonial institution. Since its formation, Unimelb has played a key role in the colonisation of Indigenous land and Indigenous bodies. In the early 1900s, the University of Melbourne was a hub for the global eugenics' movement. Today, the legacy of eugenicists continues to be celebrated through the naming of buildings across its campuses, and the University of Melbourne continues to perpetrate active harm and institutionalised racism against its Indigenous staff, students, and wider community.

In 2023, the University of Melbourne committed (as set out in Murmuk Djerring: The University of Melbourne's Indigenous Strategy) to "confront its colonial past and work towards a future where Aboriginal and Torres Strait Islander cultures, histories, and knowledges are acknowledged and celebrated". However, maintaining relationships with companies complicit in the ethnic cleansing of the Indigenous people of Palestine cannot co-exist with this stated commitment.

As the university becomes increasingly neoliberal and driven by profit, it is unsurprising that Unimelb has found the business of genocide to be profitable and dedicated itself

to the weapons industry as the future of its research focus. Note that there is a tendency to frame this research as defence-oriented, aimed at abating threats to national security. Defence research in this context, however, refers to any means of innovating and expanding weapons technologies used in the hyper-surveillance and hyper-militarisation of so-called Australia, including university campuses.

Unimelb justifies these collaborations on the grounds that the so-called Australian Government is facing a so-called “national security threat” that demands the acceleration of weapons technologies. This reflects a broader shift; so-called Australian universities have become a resource pool for the rapid development of weapon technologies, directly in collaboration with the Australian government’s mission to turn the so-called nation into a defence research hub. Paradoxically, Unimelb also claims the “dual use” argument - that these defence technologies are not primarily intended for use in weapons, but are used for other necessary objectives, such as simplified drone control and surveillance for first responders. These two claims are incompatible. More broadly, these contradictions portend deeper questions on what the University is and why public institutions like it are worth protecting.

Regardless of these misleading claims about “dual use” technologies, any research developed alongside any company whose primary aim is the development of weapons, many of whom are directly complicit in genocide, is unacceptable. The University’s ethics policies do not allow funding from the tobacco industry for any purpose. Collaborations with weapons manufacturers should be no different. They are directly instructed by the so-called Australian government, in collaboration with the “Australian Defence Force,” in their mission to hyper-militarise the country through resource pooling Universities for technology and weapons research. Again, attention to defence-oriented language is critical here, as it masks the University complicity in genocide in favour of broadening opportunities for university students for research into so-called noble causes.

The University refuses to be transparent about its research collaborations. Shrouding this information in secrecy is a strategy aimed to obscure the reality that collaborating with weapons manufacturers means collaborating with genocide. It is a tactic used to distance the University from its complicity in aiding Israel and bully any opposers into silence.

Considering the limited public information currently available, it is impossible to know the extent of the weapons and defence contracts that Unimelb has. Most of the information that have been accessible have come from the Australian Research Council Grants, the Defence departments (defence innovation reviews, minister publications regarding projects, presentations from weapons summits, media releases from the defence/weapons industry) and the University's self-publications.

All members of the University community have the right to this information. In line with this need for transparency and accountability, which is also a legal requirement for this University as a public institution, this report exposes Unimelb's collaborations with defence institutes and weapons manufacturers. It assists the community to question, oppose, and eventually remove all these collaborations on university campuses.

We would like to pay our highest respects to the Wurundjeri Woi Wurrung and Boon Wurrung people of the Kulin nation, upon whose lands much of this report has been researched and written. We acknowledge that sovereignty over these lands has never been ceded, and that all the University's land is stolen land. This land always was, and always will be, Aboriginal land. We extend our unwavering and unconditional solidarity to Aboriginal and Torres Strait Islander resistance movements. We acknowledge and honour the contributions of Indigenous people globally to anti-imperialist, anti-war, decolonial, and liberation struggles, and hope this exposé can play a small part in extending solidarity to Indigenous movements around the world.

From the river to the sea, always was, always will be.

Defence and Weapons Manufacturers

The following overview is based on research conducted by volunteers drawn from public information, representing only a fraction of the University of Melbourne's deep ties within the military industrial complex. Unimelb actively participates in the global supply chain of weapons to Israel, including but not limited to 13 different weapons manufacturers. There is clear evidence that Australia has historically and currently aids and abets Israel's genocidal regime by conducting research and development with weapons and defence companies that continue to supply Israel.

What is most disturbing is that Australia has contributed to the clearly unethical research outputs by creating various technologies including spray coatings for F-35 fighter jet parts that make it possible for Israel to inflict war crime. This output is severe, but so are the various other research outputs that seem smaller in scale. These innovate technologies assisting in the hyper-surveillance and hyper-militarisation of not only so-called Australia but Israel's apartheid, genocidal regime, and thus all forms of defence research should not be underestimated in scale of moral and legal severity.

Unimelb's refusal to condemn Israel's apartheid regime in fear of losing funding and normalisation of weapons research has created an unsafe learning environment for all community members, including but not limited to Palestinians and pro-Palestinians. Resulting from this is a loss of respect in the public eye and disdain for those in power who have created such a genocidal complex. As such, the University should be ashamed by its choices to procure and hold long-standing relationships with weapons manufacturers.

The University can no longer virtue signal policy regarding student and community safety, when the most senior members of staff have signed off on these contracts and partnerships. Nor can statements on a "dedicated website" aimed at addressing the "Conflict in the Middle East" satisfy student concerns when the title itself ignores the reality of genocide and occupation in Palestine. Long before UM4P's 8-month struggle to protect and legitimise Palestinian and pro-Palestinian voices, the University has a duty to disclose and divest from this research. Otherwise, the University cannot claim to care for student safety.

Lockheed Martin

Lockheed Martin is the world's largest weapons manufacturer which currently supplies Israel with F-35 fighter jets, including programs for weapons maintenance to commit crimes against humanity. The type of weapons that Lockheed Martin supplies have been used for some of the most grievous attacks on Palestinians, and evidence of their use has been supplied to the International Court of Justice, where a plausible case for genocide was found.

Lockheed Martin Australia was first opened in Naarm in 2016 with the creation of STElaRLab. This was the first research centre by the company outside of the United States. The company has committed $74M to establish the nation's first IAMD (Integrated Air and Missile Defence) ecosystem, called AIR6500 Phase 1 (AIR6500-1). This will form the architecture at the core of the Australian Defence Force's (ADF) future IAMD capability, which is established to increase research of and innovate technologies, weapons, and F-35 aircrafts that are used in Israel's genocide of Gaza.

The University claims to collaborate with Lockheed Martin to provide students with opportunities to conduct PhD research under the Australian Post Graduate award program. This supposedly includes further research into hypersonics, autonomy, communications, and reconnaissance amongst other areas aimed at accelerating responses to national security issues such as bushfires, unrelated to weapons manufacturing. With the aim of establishing an ongoing research presence, Lockheed Martin has signed a $360,000 deal with Melbourne University for "post-doctoral studies in C4ISR advanced algorithms."

The University is clearly proud of its relationship with Lockheed Martin by welcoming its new STELaRLab located off-campus, proximal to the University's engineering and science innovation precinct. However, Unimelb's announcement of collaborating with the world's largest weapons supplier did not go unnoticed. See below for various reports of opposition:

- **Student Union (UMSU):**
    - In a release on 13 September 2016, the Student Council formally asked for clarification from the University on this collaboration and encouraged the

University to re-examine its ethical standards in research. A university representative dismissed their concerns and did not provide further clarification.

- On 23 February 2017, UMSU reported that, a group of activists spent three days occupying the area behind Melbourne Connect that is set to become Lockheed Martin's STELaRLab. The occupation followed the Student Councils opposition to the UniMelb collaboration with Lockheed Martin.

- **"Weapons or Wellbeing" panel by the student branch of the Medical Association for Prevention of War (MAPW):**
  - In August 2017, a forum was held to discuss Melbourne University's collaboration with Lockheed Martin, joined by Professor Ricard Tanter from the Nautilus Institute and Alex Adney-Brown, a PhD student studying the lived experience of drone attacks.
  - On 18 June 2018, a letter from Medical Association for Prevention of War was sent to Chris Manzie, the head of Electrical and Electronic Engineering department at Unimelb, in response to a prior meeting, regarding BAE and Lockheed Martin. The members of MAPW made two very important arguments:
    1. The University requires all research projects at master's and doctoral level to undergo rigorous ethics review. Yet the University has provided no details of whether any ethical reviews of the University's partnerships with Lockheed Martin or BAE were undertaken, or the nature and outcome of these reviews. The ethics filters that are so strictly applied to individual research projects seem to be completely absent when it comes to weapons dealers.
    2. The University's letter of 13 June 2017, responding to the MAPW student group, claimed "fundamental research can have many applications, and it is impossible to foresee all future uses and consequences". However, this statement is highly disingenuous, given that the University's own media release when the partnership was announced talked about "deepening and broadening its

engagement with the defence industry" and "placing Melbourne University in an ideal position to assist Lockheed Martin with their research goals."

- **Meeting with University Executives:**
    - It was not until July 2018, after blockading the entrance to Raymond Priestley building, Parkville Campus for over 14 hours that the university finally agreed to secure a meeting with a university executive, to contest the relationship with Lockheed Martin. The campaign is demanding the university end all ties with Lockheed Martin, and to reveal all its agreements with the company. According to the UMSU release student activists. called for the University to cancel this agreement.
    - Andie Moore, a spokesperson for Lockout Lockheed, said, "We don't believe that weapons manufacturers should have any place in the University. To think that we are involved with corporations that actively benefit from the killing of civilians is despicable."
- **Ethical Concerns (The World Health Organization):**
    - On January 2021, The Guardian released an article titled, "The World Health Organization has ethical concerns about the university's collaboration with nuclear weapons maker Lockheed Martin." The article comes after a Nossal Institute researcher, who had applied to collaborate with the WHO's International Agency for Research on Cancer had to distance himself from the University of Melbourne during a due diligence check because of the Unimelb link to nuclear weapons manufacturer Lockheed Marrtin.
    - Note that the WHO does not engage with the arms industry, as there is no point having a global health department interested in improving global wellbeing and then having another department that is colluding in undermining it. Barbara McPake from the Nossal Institute director and Tilman Ruff, a public health infectious diseases physician and associate professor in the school of population and global health, have both expressed similar concerns.
- Unimelb for Palestine (UM4P):

- The most recent campaign to question the universities ethical duty to the community by holding partnerships with Lockheed Martin went viral when a social media video, posted on the 30th of November 2023 showed a confrontation between the current Vice-Chancellor Duncan Maskell and a Unimelb for Palestine organising member. The Vice-Chancellor deflects answering any questions to other executives of the University, clearly indicating that the fight is with the institution rather than one individual.
- Note that Duncan Maskell's role as Vice-Chancellor does hold responsibilities of accountability and transparency under the University of Melbourne Act 2009 (Vic) and the Vice-Chancellor's regulation policy.

Note that on 19 December 2023, the University of Melbourne website published a "clarification of the 13 million Dollar partnerships with Lockheed Martin." This updated statement attempts to address the concerns regarding the University's complicity to the genocide of Palestinians. Yet, it does not answer the contextual line of questioning that has been asked by many members of the university's community as far back as 2016.

The statement attempts to make their research seem innocent:

> *"Since 2016, the University of Melbourne has received $3.5m in funding from Lockheed Martin Australia to support PhD scholarships and research projects in areas such as artificial intelligence/machine learning, resource allocation and optimisation, and quantum sensing. Student projects have been in areas such as powerline safety monitoring and simplified drone control for first responders (i.e. firefighting)."*

Receiving monetary funds from a weapons manufacturer to support scholarships and research in the area of defence tech and weaponry like the aforementioned AI, machine learning, and quantum sensing technologies is not an excusable offense. This research has real world applications in the genocide of Palestinians, that have been supplied by Lockheed Martin Australia to Israel.

United Nations experts released a special procedures document titled "Arms exports to Israel must stop immediately: UN experts" (24 February 2024). The document states that any transfer of weapons to Israel that would be used in Gaza is likely to violate international humanitarian law:

“All States must ‘ensure respect’ for international humanitarian law by parties to an armed conflict, as required by 1949 Geneva Conventions and customary international law,” the experts said. “States must accordingly refrain from transferring any weapon or ammunition – or parts for them – if it is expected, given the facts or past patterns of behavior, that they would be used to violate international law.”

“Such transfers are prohibited even if the exporting State does not intend the arms to be used in violation of the law – or does not know with certainty that they would be used in such a way – as long as there is a clear risk.”

Research projects

Research Partnerships	Project Dates	Quick facts		Summary	Connection to Defence Industry
UoM x STELaRLab x TUCN (Technical University of Clu-Naponica, Romania) x UL (University Of Lorraine)	2021-2024	ARC	#DP210102600	Designing advanced control algorithms used in engineered systems through artificial intelligence, particularly optimization-based controllers, essential for smart highways, driverless cars, swarms of drones, various types of robots and advanced manufacturing systems to name a few examples.	This is linked to Lockheed Martin's role in AIR6500 Phase 1 (AIR6500-1).
		Funding	$520,208.00		
		Investigators	Prof Dragan Nesic (CI); Dr Romain Postoyan; (PI)Prof Lucian Busoniu (PI)		
UoM x RUAG Australia x Rosebank Engineering	2022-2025	ARC	LP200301355	Partnership with RUAG Australia, a supplier to the Defence aerospace industry. Project to develop accelerated designs of metal powders for cold spray amongst other advanced materials and components.	This technology has already been used to repair the rudder anti-rotation bracket on the F/A-18 Hornet aircraft and the steel landing gear component of the C-130J Hercules military transport aircraft.
		Funding	$326,590.00		
		Investigators	Graham Schaffer (CI); Prof Zhe Liu (CI); Dr Tesfaye Molla		

			(CI); Dr Christian Brandl (CI)		
UoM x TAS (Trusted Autonomous Systems) x Consunet Pty Ltd x RMIT University x University of Sydney x DST (Defence Science and Technology Group)	2019-2020	Code	Lex34201 - DUST	Distributed aUtonomous Spectrum managemenT (DUST) aims to research, develop, and demonstrate near real-time autonomous spectrum management to deliver orders of magnitude increase in agility and efficiency cost savings for Australian Defence and commerce.	The project has been a foundation for significant success for Consunet, announced in April 2022 as a partner with Lockheed Martin on AIR6500-1, developing "critical spectrum and manoeuvre technologies." Capabilities are linked here and here.
UoM x STELaRLAB [MASTERS PROJECT]	2018	Supervisor	Dr Airlie Chapman	*DE-ORBITING SMALL SATELLITES FOR NATURAL DISASTER RESPONSE (DESSNDR)* aims to model, conduct a feasibility study and map out uncertainties regarding de-orbiting options for CubeSats.	Precursor for M2 Cubesat's formation flying function in 2021, which will inform "future Defence surveillance concepts." More information here and here.
		Group members	Devon Arganaraz; Kapil Kumar; Byung yeon Mun		
		Grant number	Unknown		
		Access	Unknown		

UoM x STELaRLAB	2018	Supervisor	Professor Chris Manzie	*BEAM RIDER CONTROL FOR DRONES* uses beam-rider and laser encoding technology to show how flight control for drones can be automated using simple laser pointers.	$4.9 million contract between ADF and AIM Defence in 2024 (Melbourne-based laser developer) to produce a deployable directed energy system for use against drones. *See: Fractl:2 DE system (expected weapon to track and shoot down drone to be produced by mid-2024)*
		Group members	Stephanie Burns; Yuan Lin; Jarryd Rogers		
		Grant number	Unknown		
		Access	Pdf?		
UoM x STELaRLAB	2017	Supervisor	Unknown	Autonomous power line monitoring UAV in the field of Mechatronic Engineering. Also found in projects from the Centre for Disaster Management and Public Safety.	Unmanned Aerial Vehicles (UAVs) provide intelligence, surveillance, target acquisition and reconnaissance (ISTAR) support for land force operations. Australian Army operates RQ-7B Shadow 200 in this role.
		Group members	David Mann; Elena Vella; Rowan Skewes		
		Grant number	Unknown		
		Access	Pdf?		

2017 engineering expo [NO ACCESS]

Boeing

Boeing are world's leaders in military aircraft and weapons manufacturing globally and have played a key role in the ongoing genocide of the Palestinian people.

Boeing manufactures and sells the F15 fighter jets and the Apache AH-64 attack helicopters to the Israeli Air Force. Boeing aircrafts were deployed by Western allies to attack Yemen, for which Australia also provided logistical and intelligence support. Advanced manufacturing of parts for the F15 fighter jet and other aircrafts such as F/A-18 super hornet and P-8 Poseidon are outsourced to Melbourne-based Lovitt Technology and Marand. Additionally, Boeing makes unguided small diameter bombs. Boeing Australia develop the Joint Direct Attack Munition Extended Range (JDAM-ER) guidance kit, which converts these unguided bombs into precision-guided munitions, exclusively manufactured by Ferra in Queensland and exported since 2015, which were sent to Israel immediately after October 7th in an expedited delivery.

Boeing has created the MQ-2B Ghost Bat program, boosted $400 million by the so-called Australian government in 2024. This drone assists the Royal Australian Air Force (RAAF)—a drone which uses artificial intelligence to target enemies and is designed to protect and support traditional military assets such as the F-35 in contested environments.

The University of Melbourne currently receives funding from Boeing to optimise aircraft performance and design in an industry initiative called OPTIMA ARC. Boeing are also a client to the University of Melbourne's Walter Basset aerodynamics laboratory, further entrenching their relationship. It is plausible that Boeing is funding research students to test Boeing military aircraft components at this laboratory on the Parkville campus.

The University of Melbourne began its relationship with Boeing as early as 2005, and have coercively funnelled engineering and computer science students into the pipeline of weapons research through Boeing-funded scholarships to the Masters of Engineering. Boeing directly funds three student clubs at the university, and attempts

to wash their image of genocidal crimes by creating info sessions such as the ‘Victorian Indigenous Engineering Winter School’ and ‘Girl Power’, a female STEM student camp.

Note the controversy regarding Boeing whistleblower and dysfunctional aircrafts. Boeing, which dominates the market for commercial aircraft along with Netherlands-based Airbus, has been under intense scrutiny over its safety record since two fatal crashes involving the Boeing 737 MAX in 2018 and 2019. Following this, a former Boeing employee who blew the whistle on alleged safety problems at the aircraft manufacturing giant has been found dead. Brian Knowles and Robert Turkewitz, lawyers who represented Barnett, said their client had been in the midst of a deposition in a lawsuit against Boeing after suffering retaliation and a hostile work environment for exposing serious safety problems with the Boeing 787 Dreamliner. There was no indication that he would take his own life.

Research projects

Research Partnerships	**Project Dates**	**Quick facts**		**Summary**	**Connection to Defence Industry**
UoM x Monash University x Lancaster University x The University of Warwick x University College Cork x CSR Limited x Future Fibre Technologies x AUSNET Services (Transmission) x Woodside Energy x IBM Australia x Melbourne Water Corporation	2021-2027	ARC	IC200100009	The OPTIMA ARC Training Centre will partner with Australian companies to develop an industry-ready optimisation toolkit that will tackle complex decision making and enhance market position, with applications in defence, space, and transport sectors. *Crucially, it will train a highly skilled future workforce and address a critical skills shortage that currently represents an estimated $315 billion missed opportunity for the Australian economy.* ARC CEO Judith Zielke officially launched Centre in 2021 at Melbourne Connect innovation	OPTIMA is a partnership between the University of Melbourne, Monash University, two international universities and nine industry partners. During its first 12 months, over 100 researchers worked with industry partners in the advanced manufacturing, energy resources and critical infrastructure sectors, including AGL, Melbourne Water, Future Fibre Technologies, Mecca Brands, ProbeCX, Southeast Water, Boeing Australia, the Australian Bureau of Statistics and ENGIE. Learn more about OPTIMA here. ***Notably, Boeing Aerostructures Australia and IBM Australia are***
		Funding	Expected expenditure for Unimelb is $4,861,236.00		
		Investigators	Unknown		

				precinct in Parkville, with Unimelb Vice-Chancellor Duncan Maskell and Monash University Vice-Chancellor Margaret Gardner. The collaborations across Unimelb include: new molecules in School of Chemistry; management of water resources in School of Ecosystem and Forest Sciences; Materials Engineering design of polymers; optimisation in epidemiology and fire management.	***some of the organisations partnering with OPTIMA ARC Training***, conducting research to optimise aircraft performance and design. Note that Unimelb is focused on Cyber Security research, with international collaborations including US, China (excluding SARs and Taiwan), Germany, Hong Kong (SAR of China) and Switzerland. Monash University is focused on Medical Technologies and Pharmaceuticals, internationally collaborates with Netherlands, England, and France, and partners with other companies, such as NOVO NORDISK A/S. See information here.
UoM	2021	GA ID Funding	GA69594-V2 $990,000.00	**Whopping Volta GPU Cluster – Transforming Artificial**	Nvidia has completed acquisition of Israeli chip designer Mellanox

		Researchers	Dacheng Tao (Chief Investigator); Jinhong Yuan (Chief Investigator); Maurice Pagnucco (Chief Investigator); Prof Branka Vucetic (Chief Investigator); Prof Dr Mohammed Bennamoun (Chief Investigator)	**Intelligence Research.** Artificial intelligence (AI), as it continues to grow and evolve, is taking an increasingly leading role in strategic plans of the world's leading economies, IT companies, and universities, with the promise to be a key driver in innovation, science, education, and society. This project will establish a whopping Volta graphical processing unit Cluster (wVGC) with the aim of smashing current impediments to compute-intensive AI research. The wVGC features a contemporary HPC system equipped with 120 most advanced NVIDIA Volta GPUs distributed in 30 high capable nodes. The wVGC will transform AI research in Australia, putting us on	Technologies for $6.8 billion, in a deal to help the firm boost its data centre and artificial intelligence (AI) business. Nvidia (formerly known as a provider of gaming chips) now provides chips to speed up AI tasks such as teaching servers to recognise images. Consider that Mellanox makes chips that connect those servers together inside the data centre. The company plans to grow Mellanox's business and data centres in Israel. The Israeli military has reportedly used AI-powered databases to identify targets for its bombing campaign in Gaza. This database is isolating and identifying thousands of Palestinians as potential bombing targets using an AI-assisted targeting system called Lavender. This is problematic as, from

				the same footing as leading research groups around the globe, and at the forefront of the world's AI revolution.	a technical perspective, it is difficult to keep a human in the loop to provide meaningful oversight to AI systems that scale warfare.

Bae Systems

BAE Systems is one of the largest defence contractors in Australia and a key supplier to the F-35 program. Its UK partner (BAE Systems plc) acts as one of Lockheed Martin's principal partners in the design, build and maintenance of the F-35, holding about 13-15% share globally of each F-35 aircraft. BAE Systems Australia assists in the production of titanium components for the F-35 vertical tails, is responsible for the producing wiring boards and assemblies, cable assemblies, as well as selected communication components connected to Israel's genocidal mission against Palestinians.

The company also contributes to the MQ-2B Ghost Bat program, boosted $400 million by the so-called Australian government in 2024. This is being developed by Boeing for the Royal Australian Air Force (RAAF)—a drone which uses artificial intelligence to target enemies and is designed to protect and support traditional military assets such as the F-35 in contested environments.

Collaboration with academia and industry is aimed at developing research for weapons systems integrators. This is conducted at the New Fisherman's Bend manufacturing and innovation centre, selected to supply the Australian Army with its AMV35 Combat Reconnaissance Vehicle (CRV). Opportunities for "graduate placements, internships, research and development activities" are presented as the forefront for justifying the use of UoM as a leading research hub for the development of weapons technologies.

Additionally, the Israeli-based vehicle manufacturer Plasan Sasa has already links in Australia through collaboration with BAE Australia for the Hunter Class frigate by incorporating Australian armour steel by Bisalloy into Plasan's survivability solutions (also see Thales section).

The problematic nature of these partnerships is connected to the increasing militarization of university campuses. Innovated technologies conducted through university research projects are used to commit war crimes and genocide against the Palestinians. Universities have downplayed the nature of these partnerships to frame it solely as an innovative research mission, increasing opportunities for master's and PhD projects. In reality, there are serious ethical concerns, with BAE Systems facing allegations of bribery and fraud. For instance, BAE System airplanes that are sold to Saudia Arabia (which represents 21% of its sales) are used in the continual bombardment of Yemen.

Research projects

Research Partnerships	Project Dates	Quick facts		Summary	Connection to Defence Industry
UoM x University of Adelaide	2021-2024	ARC	Unknown	This project aims to exploit advanced AI techniques to deliver autonomous platform capable of robust and persistent operation in complex, contested land environments.	The UK's armed forces and Defence Science and Technology Laboratory (DSTL) have collaborated with the US and Australia in an AUKUS trial to accelerate the adoption and understanding of artificial intelligence (AI) and autonomous systems, called the Trusted Operation of Robotic Vehicles (TORVICE). More information here and here.
		Funding	Unknown		
		Investigators (/Team)	Prof Chris Manzie (UoM); Prof Lipovetsky (UoM); Prof Willian Moran (UoM); Prof Michael Cantoni (UoM); Reid (UoA)		
UoM x University of Queensland x The Australian National University x University of	2021-2024	ARC	LP190100104	Co-design and dynamic mission optimisation of hypersonic flight vehicles, due to Australia's national security reliance on geographic isolation and support from allied forces supposedly being challenged.	DST Group has an active program to develop hypersonics, especially supersonic combustion ramjet (scramjet) propulsion to enable sustained high-speed flight in the atmosphere.
		Funding	$390,529.00		
		Investigators (/Team)	Prof Chris Manzie (CI); Prof Iman Shames		

Southern Queensland			(CI); A/Prof Ingo Jahn (CI); Dr William Moase (PI); Prof Peter Dower (CI)	Innovated computational tools intended to create spillover benefits into other complex system domains.	Hypersonic Manufacturing is using the UoQ team to produce an engine part for the DART AE, a three-metre-long, single-use vehicle, powered by a hydrogen-fuelled SPARTAN scramjet engine.
UoM x TAS (Trusted Autonomous Systems) x University of Adelaide x DST (Defence Science Technology Group)	2020-2023	Researchers	Chris Manzie; Michael Cantoni; William Moran; Nir Lipovetzky	BAE Systems Australia and Trusted Autonomous Systems (TAS) have recently completed a four-year research and demonstration program, during which they developed an artificial intelligence system that could be used in uncrewed ground vehicles (UGV). The TAGVIEW (Trusted Autonomous Ground Vehicles in Electronic Warfare) system would allow multiple UGVs to operate simultaneously to carry out mission objectives while	TAGVIEW has been a unique collaboration, bringing together the strengths of Defence, industry and academia to fast track the development of a transformative autonomous technology aimed at providing Australia and allies with capability advantage on a "future battlefield." Two Mk6 platforms were given to ADF Academy and four Mk7 UGV platforms were delivered to Defence Science and Technology groups in Adelaide and Melbourne. The unmanned ground vehicles, also known as mules, are

				identifying and evading potential threats.	remote-controlled six-wheeled vehicles capable of carrying up to 600kg.
UoM x DST (Defence Science Institute Group) x DEFENDTEX x TECTONICA	2020-2023			Trusted Autonomous Systems Defence Cooperative Research Centre. This works on Land Domain – Networked Autonomy which includes uncrewed ground vehicles (UGV) highly sophisticated navigation, mapping, vision, and safety systems	Trusted Autonomous Systems is Australia's first Defence Cooperative Research Centre. DST Group and ADF utilise TAS research to support the following operational areas: operating in a contested chemical, biological, radiological and nuclear (CBRN) threat environments, agile command and control, and information warfare.
UoM	2011-2015	ARC Funding Investigators (/Team)	LP110200025 $290,014.00 Prof Chris Manzie (CI); Prof Andrew Ooi (CI); Prof Nicholas Hutchins (CI)	Optimal design of controlled aerodynamic bodies: from concept to prototype. This interdisciplinary project will deliver technological advancements in areas of fluid dynamics, control systems & optimisation. Intended to have a "direct effect on Australian defence capability."	Assisting in the Australian Air Force's defence capabilities, through a 2022 trilateral agreement between the Royal Australian Air Force (RAAF), United States Air Force (USAF) and the Royal Air Force (RAF) to work together under an (AUKUS) E-7 Joint Vision Statement towards collaboration and interoperability.

Raytheon

Raytheon provides weapon systems, components, and maintenance services to the Israeli Air Force's fleet of F-15, F-16, and F-35 fighter jets. It manufactures the Paveway II Guided Missile for Israel in the US and the Paveway IV in Glenrothes. Raytheon Australia is a capability partner for the Australian Defence Force aimed at delivering multi-domain solutions, providing tactical and strategic satellite communications, space situational awareness, cyber security and asset management for ADF facilities. There are several facilities, with the most recent opening being the advanced Centre for Collaboration in southeast Queensland. The new centre will serve as a central hub for electronic warfare, air traffic management, ground-based air defence, and integrated logistics, and will help facilitate collaboration with small and medium enterprises (SMEs) and Defence.

Raytheon BBN Technologies has been awarded $2.2 million in funding under the quantum computer science (QCS) program sponsored by the Intelligence Advanced Research Projects Activity (IARPA). BBN is a wholly owned subsidiary of Raytheon Company. The goal of the program is to create tools and methods that integrate all aspects of the quantum computer, from hardware to software, in a single framework, resulting in unified resource management and realistic performance assessment. This will enable more informed decisions about where to direct ongoing quantum computing research and development. Additional program partners include NEC, the University of Waterloo and the **University of Melbourne.** *See section on Phasor Innovation for more information regarding the use of Quantum engineering for defence and warfare capabilities.*

Research projects

Research Partnerships	**Project Dates**	**Quick facts**		**Summary**	**Connection to Defence Industry**
UoM x Arizona State University (ASU) x Fast Mathematical Algorithms and Hardware (FMAH) x Georgia Institute of Technology (Georgia Tech) x University of Michigan (UM)	2005-2007	Name	*[The Raytheon Company, Missile Systems (Raytheon)]* Integrated Sensing Processor (ISP) Phase 2 Third Quarterly Progress Report for Period of Performance	To raise the quality of data and classification results, minimize computation, power consumption, and cost, future systems will require that the sensing and computation be jointly engineered. ISP is a philosophy/methodology that eliminates the traditional separation between physical and algorithmic design. The improvements intended to demonstrate here are applicable in a general sense; however, this program will focus on distributed sensor networks and missile seeker systems.	The prototype MANTIS (Mutual-Axis Neuromorphic Twin Imaging System) sensor is the result of the work of the University of Sydney Nano Institute and Air Force's Jericho Disruptive Innovation. This is a sensor that has shown potential to measure the speed and predict the trajectory of incredibly fast-moving objects has been developed in a partnership between Air Force and **university researchers.** The Defence Science and Technology Group (DSTG) was also involved in the collaboration, providing early guidance and input. Future iterations of MANTIS could also see it combined with a robotic eye to allow for surveillance of
UoM x DSTG x University of NSW x	2004-2010	ARC Funding	RN0459979 $2,366,043.00	*ARC Research Network on Intelligent Sensors, Sensor Networks*	

University of Technology Sydney x Curtin University […]		Investigators	Prof Marimuthu Palaniswami (CI); Prof Adrian Baddeley (NP); Prof Peter Bartlett (NP); Prof Natashia Boland (NP); Prof Abdesselam Bouzerdoum (NP) […]	*and Information Processing.* This research network brings together an interdisciplinary team of outstanding Australian researchers representing all the key disciplines required to successfully deploy sensor networks and links this team with the foremost international authorities and leading industry players in the area of sensor networks. This research network will guide collaborative research that will ensure Australia to play a world leading role in sensor network development and implementation.	large portions of airspace looking for air vehicles passively driving around.
		Collaborations	[International] Canada; Germany; Hong Kong; Netherlands, The; UK; US		

Leonardo

Leonardo is an Italian government-controlled arms company which produces composites and metal structures for the F35 program. They sell weapons directly to the Israeli military, as seen in new armoured fighting vehicles (AFVs) such as the eight-wheeled 'Eitan', used in the recent invasion and military invasion in Gaza (post October 7, 2024). The most recent contract was for the AW119Kx helicopters in 2022, purchased with $29 million in US government funding from their US operations. The design and manufacture of weapons of war is a global industry of death, serving only the interests of states and corporations at the cost of human lives from Palestine to West Papua and more.

Leonardo Australia, the Australian subsidiary of Leonardo, is an industry partner of the DSTG. Note that Leonardo Australia is a key player within the Australian Defence Industry, with its head office located in Fisherman's Bend. Leonardo has been supplying Defence Electronics in Australia for over 50 years with leading-edge radar systems, sensors, and technologies to support territory and maritime surveillance. The company has a range of rotary wing solutions including conventional, tiltrotor and UAS systems. It has assisted in the development of the F-35A Lightning II, which is the Australian Defence Force's first fifth-generation air combat capability. Other aircrafts they assist in developing include the EA-18G Growler, the F/A-18F Super Hornet, amongst others.

The Australian subsidiary and the University of Melbourne have signed a Memorandum of Understanding (MoU) to collaborate on research projects related to new space technology developed at the Melbourne Space Laboratory (MSL) (7 Dec 2022). MSL is developing a thermal management and control system that improves the performance of remote sensing and satellite tracking and detection systems, specifically for applications for defence (Space Domain Awareness). The collaboration between the two parties aims to design, prototype, and qualify an improved payload (carrying capacity) in a space environment, with the possibility to integrate and enhance Leonardo products such as the Infrared Detectors and Hyperspectral Sensors.

The Melbourne Space Lab (founded in 2019) develops innovative technological solutions and payloads for nanosatellites. This Lab works with experts in artificial intelligence and edge computing in the University of Melbourne Faculty of Engineering and Information Technologies to develop on-board data processing capabilities for the Melbourne Space Lab's payload management system. Payloads are the components that allow a satellite to accomplish its mission, like sensors for surveillance or antennas for communications. Two projects are particularly noted here:

1. SpIRIT (Space Industry Responsive Intelligent Thermal): SpIRIT is the first satellite funded for development and launch by the Australian Space Agency (on 1st December 2023) with an award of $3.95 million to the Melbourne Space Laboratory for its design, fabrication and test, and launch. Its main instrument – an advanced sensor for gamma and x-rays for astrophysics and remote sensing – is provided by the Italian Space Agency. Partnerships involve Neumann Space, and three additional Australian companies (Inovor Technologies, Sitael Australia, and Nova Systems).
2. SkyHopper: SkyHopper is a mission concept under development (funded for phase A/B) for a 12U nanosatellite equipped with a low-noise, rapid response infrared telescope. It also aims to be the first CubeSat in the world to carry out cryogenic infrared observations from space, hopefully to reduce costs and feasibility for space-based infrared space situational awareness.

The project is funded by the Australian Space Agency as its first space mission through the International Space Investment - Expand Capability scheme. The result of an international collaboration between the Italian Space Agency and the University of Melbourne, SpIRIT includes Australian industry partners Inovor Technologies with responsibility for the spacecraft platform, Neumann Space providing a thruster subsystem for the satellite, SITAEL Australia for systems engineering and Nova Systems for ground segment support.

Research projects

***note: could not find specific details of these projects. It is likely under the guidance of other partnerships such as the DSTG.*

Research Partnerships	**Project Dates**	**Quick facts**		**Summary**	**Connection to Defence Industry**
UoM (Melbourne Space Program)	Current	Name	ACRUX-2 (CUBESAT)	A student-based team will design, build, and launch a 3U CubeSat bus, as well as construct a dedicated ground station. Future missions will make use of this foundation, ultimately enabling the deployment of a hyperspectral camera; technology.	Buccaneer is a collaborative Australian project to jointly fly and operate two CubeSat missions developed by the DSTG (Defence Science and Technology Group) and UNSW (University of New South Wales) Canberra Space. It is highly significant in the context of Australian space activities as it will be the first, sovereignly developed defence-science CubeSat mission flown by Australia.
UoM (Melbourne Space Program)	Current	Name	Humanoid	The dedicated team will be creating the physical form of the humanoid using CAD and 3D printing, bringing this to life	Collaborations with universities and private companies have intensified, pooling resources and expertise to push the boundaries of what 3D

				through programming microcontrollers integrated with electronic hardware, and developing a wide range of software utilising artificial intelligence and machine learning to create an overall human-like experience.	printing could achieve in defence applications. One of the notable early milestones in the use of 3D printing in Australian defence was the deployment of 3D printed components in military equipment and vehicles, marking a shift from prototyping to functional use. Some components include composite materials, ceramics, and bio-compatible and medical grade materials. This supports other research projects at Unimelb, such as DefendTex and Thales' research on body armour amongst others.
UoM (Melbourne Space Program)	Past	Name	Bushfire mapping (machine learning)	The team is developing a machine learning based model that uses data from satellite imagery and elevation maps, assesses the temperature in the area, and looks at historical data in order to	See research on *CubeSat.*

				establish patterns. This information will help calculate the risk-level of a fire and determine what level of response is needed.	
UoM (Melbourne Space Program)	Past	Name	ACRUX-1 (CUBESTA)	CRUX-1 was the effort of a dedicated multi-disciplinary team and one of the first completely student-led satellite development and launch initiatives in Australia.	Potential link to Lockheed Martin project (DESSNDR), precursor for M2 Cubesat's formation flying in 2021.

Rosebank Engineering

Rosebank Engineering (formerly RUAG Australia) is a sole source supplier to the F-35 program providing over 150 components for the landing gear and weapons bay systems on all three variants. Its uplock actuator system opens and closes the weapons bay doors in seconds enabling the aircraft to drop its payload of munitions quickly to maintain its stealth capacity. Operating under sub-contract to F-35 aircraft OEM (acompany that produces parts and equipment that may be marketed by another manufacturer) and global sustainment prime contractor Lockheed Martin, Rosebank is the preferred Component Maintenance, Repair, Overhaul & Upgrade (CMRO&U) assignee on five Repair Technology Groups (RTGs) of the F-35 platform in the Indo-Pacific Region.

The company also contributes to the MQ-2B Ghost Bat program, boosted $400 million by the so-called Australian government in 2024. This is being developed by Boeing for the Royal Australian Air Force (RAAF)—a drone which uses artificial intelligence to target enemies and is designed to protect and support traditional military assets such as the F-35 in contested environments.

In 2014, Rosebank opened a metal processing and finishing facility in Wingfield (northern Adelaide) to treat and finish the F-35 vertical tail components manufactured by Marand for BAE Systems. In October 2023, Rosebank announced the activation of its F-35 Wheels & Brakes Repair Depot at Bayswater in Melbourne. Rosebank Engineering in Melbourne produces uplock actuators which are essential for the operation of the weapons bay doors Operating under sub-contract to prime contractor Lockheed Martin, Rosebank is the preferred component maintenance, repair, overhaul & upgrade (CMRO&U) assignee on five repair technology groups (RTGs) of the F-35 platform for the Indo-Pacific region.

Rosebank is part of ASDAM, a leading sovereign defence, advanced manufacturing and sustainment company that provides end-to-end capability across design, engineering, manufacturing, assembly and sustainment. ASDAM includes Marand, TAE Aerospace, Rosebank Engineering and Levett Engineering. ASDAM's role is to provide continued access to capital and resources to build and grow sovereign industrial capability and is Australia's largest supplier to the F-35 Joint Strike Fighter Program. Select customers include Lockheed Martin, BAE Systems, Honeywell, Pratt & Whitney, and BHP.

Research projects

Research Partnerships	**Project Dates**	**Quick facts**		**Summary**	**Connection to Defence Industry**
UoM	2022-2025	ARC	LP200301355	Computational alloy design for cold spray deposition. Partnering with Ruag Australia, the aim of this project is to design a new generation of proprietary, high-performance alloys and composites that are optimised for cold spray deposition. Cold spray is a new manufacturing technology that is used to create coatings for enhancement, repair, restoration and for additive manufacturing.	Innovation of alloys and composites are necessary for repair and improvement of F-35 fighter jets.
		Funding	$326,590.00		
		Investigators	Prof Graham Schaffer (CI); Prof Zhe Liu (CI); Dr Tesfaye Molla (CI); Dr Christian Brandl (CI)		

Thales

Thales is the leading supplier of air, land, naval and joint forces (particularly to NATO) based on the C4ISR approach and specialises in interoperable systems.

C4ISR stands for Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance.

Thales has a relationship with Israeli Aerospace Industries (IAI) and Elbit. The Thales-IAI partnership has produced the Sea Serpent, a surface-to-surface guided missile with a kill range of 200 kilometres. The Thales-Elbit partnership involves a subsidiary company UAV Tactical Systems (U-TacS), which makes killer drones.

Thales Australia is a trusted partner of the Australian Defence Force and various research institutions (including UoM) for the development of advanced technologies.

For instance, Saildrone's high-endurance Uncrewed Surface Vehicles (USV) coupled with Thales Australia's newest evolution of the sovereign designed and manufactured Towed Array Sonar, the Blue Sentry, will enhance surveillance and monitoring capabilities for open-ocean hydrographic surveys and maritime domain awareness (MDA) missions that require persistent wide area coverage. This will be deployed from shore to conduct autonomous underwater ISR (Intelligence, Surveillance, Reconnaissance) missions for extended durations and in all weather conditions.

Research done in Australia has produced various vehicles and systems including the 1000th Hawkei (a C41 integrated vehicle), described as a "force multiplier" for the ADF as it contains an advanced mission system integration. Also produced is the Panoramic Above Armour Gimbal (PAAG), which enables long-range threat detection, identification and weapon aiming on the move, as well as fire support capabilities.

The Israeli-based vehicle manufacturer Plasan Sasa has links in Australia has a collaboration with Thales Australia for LAND 121 Phase 4 and the Hawkei program, which had a cabin designed, tested, and produced by Plasan. As such, Plasan Sasa has plans to establish a local subsidiary in Australia to be named Plasan-Australia. It is expected that this supports the Australian Defence Force's Phase 3 contracts.

Further, The Defence Innovation Hub has awarded a contract to Thales Australia, valued at $227,000, to explore development of an innovative optics system for use with the current in service Enhanced F88 rifle to provide enhanced targeting capability and shooter accuracy on operations. This is linked to the decision of the Australian Army to partner with the Defence Innovation Hub and in turn award three innovation contracts to Australian industry.

Strategic alliances with organisations include:

- Defence Science and Technology Group (DSTG)
- The Australian Department of Defence's Research and Development Department
- Defence Materials Technology Centre
- Australia Nuclear Science and Technology Organisation

Research projects

Research Partnerships	Project Dates	Quick facts		Summary	Connection to Defence Industry
UoM x RMIT University x Swinburne University of Technology x BLASTSAFE INTERNATIONAL PTY LTD X THE TRUSTEE FOR THE ALFANO TRUST	2016-2019	ARC	LP150100906	The project team has developed a novel auxetic composite system with superior performance based on the latest developments in auxetic technologies. The system was developed with a focus on protecting civil and defence infrastructure from extreme loads. The numerical and numerical research framework has been developed to assist structural engineers in the protective design of critical structures for civil, mining, and defence industries.	The Defence Innovation Hub has awarded a contract to Thales Australia, re: Enhanced F88 rifle.
		Funding	$404,216.00		
		Investigators	Prof Tuan Ngo (CI); Prof Yi-Min (Mike) Xie (CI); Prof Priyan Mendis (CI); Prof Peter Lee (CI); Prof Dong Ruan (CI); Prof Nelson Lam (CI); Dr Dinesh Kumar Shanmugam (PI)		
UoM		Name	Auxetic Armour System for	This research investigates the auxetic oval structure for its	Prof Ngo leads:

			Protection Against Soil Blast Loading.	protective capabilities with a focus on energy absorption. Quasi-static and dynamic testing was conducted on samples to quantify the response over strain rates ranging between 0.001-100 /s. It was found that the auxetic oval structure displayed the classic stress-strain response for energy absorption with a flat plateau stress region.	1. the Advanced Protective Technologies of Engineering Structures (APTES) Research Group which has been recognised as one of the leading centres in safe and sustainable systems, and physical infrastructure protection in Australia and the Asia Pacific region. 2. a team of researchers in Protective Armoured Systems of Defence Material Technology Centre (DMTC). His team developed novel material testing and characterisation techniques & multi-scale simulation framework for modelling ultra-high strength armour materials and vehicle structural components subjected to extreme mine blasts and ballistic attacks.
		Type of document	Thesis submitted for degree of Doctor of Philosophy – Engineering January 2020 Department of Infrastructure Engineering		
		Author	Steven John Linforth		
		Supervisor	Prof. Tuan Ngo		
UoM x University of Wollongong x State University of New York, Buffalo	2017-2020	ARC	DP170100851	The project demonstrated the strong potential of innovative	The 11 published outputs attracted further funded projects from the
		Funding	$314,764.00		

		Investigators	Prof Tuan Ngo (CI); Prof Alex Remennikov (CI); Prof Priyan Mendis (CI); Prof Andrew Whittaker (PI)	structures inspired by nature in protective structural engineering applications. Through extensive numerical simulations, advanced manufacturing-driven prototyping and experimental testing, the developed proof-of-concept bioinspired prototypes were shown to exhibit improved protection over their equivalent engineered counterparts under blast loads.	Defence Science and Technology Group and Thales in the development of armour systems for mitigating blast and impact loads on structures and personnel, which will yield far reaching benefits and save lives in the future. The project also resulted in 2 PhD completions
UoM	2019-2022	Grant number	My IP 8419	*Protective Performance of Bio-Inspired Body Armour Composites Under Dynamic Impacts.*	Minister for Defence Industry, the Hon Christopher Pyne MP announced Defence has executed three Defence Innovation Hub contracts, with a combined value of $2.2 million. One of the contracts contract awarded to DefendTex,
		Researchers	Prof. Tuan Ngo		
UoM	2021	Researchers	A Ghazlan; T Ngo; P Tan; YM Xie; P Tran; M Donoug	Review (2021) above research indicates that the investigations that have been found to be most relevant to the development of bio-	

		Funding	This research was funded by the DSTG & the BioInspiration Hallmark Research Initiative at Unimelb. Funding amount not disclosed.	inspired armour systems for dynamic impact resistance have also been discussed. This discussion can inspire the design of lighter and flexible bio-inspired armour systems that are more efficient in resisting ballistic attacks.	valued at $957,000, will explore **the development of a low profile body armour for potential use in combat operations.** *Note that Thales Australia was awarded the third contract, aimed at developing an innovating optics system to service the Enhanced F88 rifle*.
UoM x OPEN CERAMICS x ELSEVIE	2023	My IP	ID8419	*Advanced manufacturing methods for ceramic and bioinspired ceramic composites: A review.* Review is offered of advanced/potential manufacturing techniques available to fabricate	
		Researchers	Keivan Nazari; Phuong Tran; Ping Tan; Abdallah Ghazlan; Tuan D Ngo; Yi Min Xie		

		Funding	This project was funded by the DSTG Australia. Funding not disclosed.	ceramic and bioinspired ceramic composites. Ceramics and ceramic composites are often utilised for armour applications, where light weight and ballistic protection are essential. These methods encompass powder-based techniques (e.g., Selective Laser Melting/Sintering, Binder Jetting) used for prototyping porous ceramic structures, as well as vat polymerisation (e.g., Stereolithography, Digital Light Processing) and Slurry-Based Deposition (e.g., Direct Ink Writing, Fused Deposition Modelling), employed for fabricating dense ceramic parts.	

Northrop Grumman Corporation

The Northrop Grumman Corporation is one of the largest military companies manufacturing multiple weapon systems used by the Israeli military against Palestinian civilians. Northrop Grumman Australia is a strategic partner of the Australian Defence Force. Capabilities include multi-domain operations such as the MQ-4C Triton Unmanned Aircraft System, satellite communications and advanced weapons systems and ammunition.

Note the following capabilities of Northrop Grumman Australia:

- The company is the prime system integrator on the Commonwealth's Joint Project 2008 Phase 5B2, providing satellite communications capability for the ADF.
- The company's Operating Unit is focused on system-of-systems integration across air, land, sea, and space, as part of the ADF's Integrated Air and Missile Defence (IAMD) ecosystem.
- Northrop Grumman landed a $200 million contract in 2017 for the through-life-support of the Royal Australian Air Force C-27J Spartan Battlefield Airlifter fleet.

Note there is a connection to Elbit Systems and Lockheed Martin.

- Northrop Grumman has an agreement with Israel's largest military contractor, Elbit Systems, to provide components that are key for producing Lockheed Martin's F-35 warplanes, including the ALQ-131 warfare system and the AN/APG-68(V)9 fire-control radar.
- A joint venture with Lockheed Martin was also conducted to manufacture the AN/APG-78 Longbow fire-control radar system. This was designed specifically for Apache attack helicopters for use with AGM-114L Longbow Hellfire laser-guided missiles.
- Northrop Grumman Italia provided its LISA-200 Attitude Heading Reference System (AHRS) to the Israeli military's fleet of M-346 advancing trainer aircraft. Note that the AHRS was part of a larger contract for avionics upgrades provided by Northrop Grumman for the Israeli M-346 program.

Research and development in advanced technologies is supported across a wide range of educational institutions in Australia including leading universities. Northrop carried out the structural design for Unimelb's Melbourne Connect: a STELaRLab (Lockheed Martin) facility aimed at developing research for advanced defence technologies, including human-machine interfaces, sensor technologies, advanced materials, medical countermeasures, enhanced human performance and autonomous systems (described on page 46 of the Avalon 2023 document).

Prof. Tansu Alpcan from Unimelb is one of three professors selected by Northrop Grumman Mission Systems (NGMS) for the Northrop Grumman Professorial Scholarship (2017) for research on Cognitive Human-Machine Interfaces and Interactions (CHMI2) for Aerospace and Defence Systems. The initial grant was aimed at being used within the CPAS Group to support research in CHMI2 for Military Aircraft, Command and Control (C2) and Remotely Piloted Aircraft Systems (RPAS) and will allow establishing new collaboration pathways in defence and mission systems. The other two professors are Prof. Roberto Sabatini from RMIT University and Prof. Robert Malaney from the University of New South Wales.

Award ceremony at RMIT University. Left to right: Min Gu, Pier Marzocca, Chris McConville, Roberto Sabatini (RMIT); Neta Ezer and Eric Reinke (NGMS).

Research projects

Research Partnerships	Project Dates	Quick facts		Summary	Connection to Defence Industry
UoM	2020-2023	ARC	LP190101287	*RAINBOW – RadIo Networks Based On machine learning for situation aWareness.* This project aims to develop software-defined and cognitive radio networks (SDR) to detect adversarial communications & achieve situation awareness on radio frequency (RF) spectrum. AI methods & wireless networks such as 5G to be used in future against adversarial attacks. Expected outcomes include strategic alliance between UoM and Northrop Grumman, which aims to increase access to university research with an emphasis on developing R&D partnerships in Australia.	DST Group and Northrop Grumman Australia have a strategic alliance to conduct collaborative research in a range of high-end defence technologies. The agreement provides DST with access to Northrop Grumman's specialised defence knowledge in unmanned systems, cyber, C4ISR and logistics.
		Funding	$345,844.00		
		Investigators	Prof Tansu Alpcan (CI); Prof Christopher Leckie (CI); A/Prof Sarah Monazam Erfani (CI); Mr Justin Kopacz (PI)		

Phasor Innovation

Phasor Innovation Pty Ltd is an independent Australian owned SME servicing the defence sector. Areas of service include radio frequency, microwave engineering, electromagnetics, system integration and quantum engineering.

Quantum sensor development is being conducted by Phasor Innovation and their partners, Unimelb and RMIT University. This is connected to the National Quantum Strategy from the Department of Industry, Science and Resources. One of the Action points describes the effort to utilise STEM students for innovating Australia's defence capabilities, as seen below:

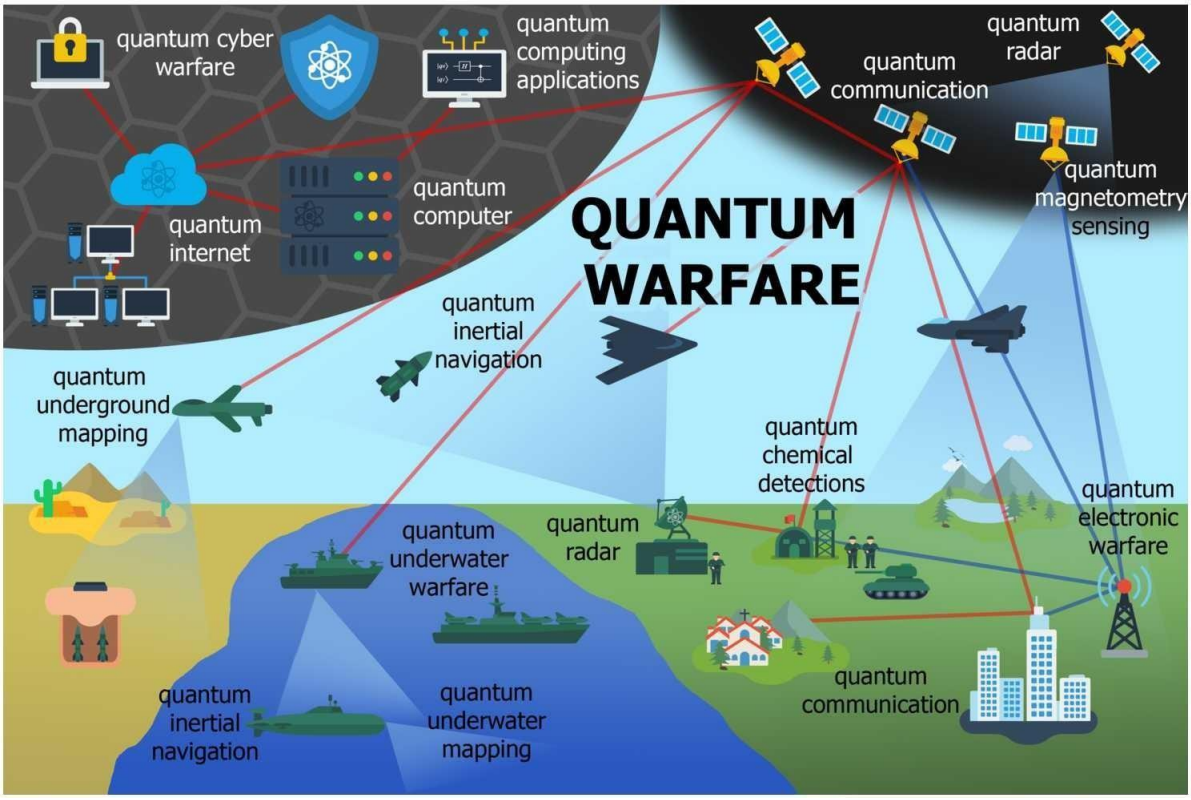
> Action 3.1: *Deliver the National Quantum Collaboration Initiative and quantum technology talent PhD scholarships, to lay the foundations for a nation-wide model for academic collaboration.*

The formal collaboration research agreement between Phasor Innovation, Unimelb, and RMIT University is part of the Next Generation Technologies Fund (NGTF), managed by the Defence Science and Technology Group (DSTG). This is aimed at developing Australia's first fully sovereign quantum magnetic global navigation platform for operation in GPS-denied environments. Note that the NGTF focuses on fundamental research and development of game-changing concepts aimed at producing further capabilities for Defence purposes.

The collaborative university and industry team successfully competed in the inaugural Army Quantum Technology Challenge in 2021 and are currently working together on a subsequent project to design, construct, test and evaluate a quantum diamond-based vector magnetometer that will provide improved surveillance and detection of subterranean targets. The team has also received funding from Defence to further develop the technology for precision magnetic navigation in GNSS-denied environments.

Using sensitive quantum magnetometers in combination with Earth's magnetic anomaly map is another way to realise quantum non-GNSS navigation to improve navigation on airborne, sea, or ground vehicle platforms. Even though quantum technologies do not generate new weapons, their improvement of present military

technology will sharpen such capabilities, shortening the time for an attack, warning and decision making. The preventive arms control of generic dual-use technologies such as quantum technologies is difficult because they can be used for civilian applications too, such as in quantum sensing for medicine. However, see below for the various ways in which quantum engineering can be used for warfare, especially through innovation in nanotechnologies:



Sketch of quantum warfare utilising various quantum technology systems.

Intentions to develop quantum warfare research is seen through the 2022 AUKUS Quantum Arrangement. These quantum advances in Australia's civilian sector could be harnessed for military applications in areas like computing, cryptography, sensing and logistics management. As such, the Australian Department of Defence announced in 2023 that it is partnering with startup Q-CTRL to develop quantum sensors to aid navigation for military platforms, a move that could ultimately benefit the Pentagon as members of the international AUKUS alliance pursue high-tech alternatives to GPS (as they can be unavailable or untrustworthy, with potential for jamming or spoofing by hostile adversaries).

Research projects

Research Partnerships	Project Dates	Quick facts		Summary	Connection to Defence Industry
UoM x RMIT x Commonwealth Scientific and Industrial Research Organisation	2024	ARC	IM240100073	Next generation diamond quantum sensors for future industries. This project aims to commercialise a diamond-based quantum magnetic sensor, pioneered in Australia with applications in a range of industry sectors including healthcare, mining, space, defence, automation, and manufacturing.	The Quantum Diamond Magnetometry team is funded by the Army and the Defence Science and Technology Group (DSTG) to design and build ultra-sensitive quantum vector magnetometers that can operate in complex urban environments. Directional magnetic field sensors are emerging as an alternate solution for navigation, especially in environments where access to GPS is denied or not available. The sovereign quantum technology has been pioneered in Australia and leverages significant government investment which allows the technology to be fast-tracked and commercialised
		Funding	$1,130,000.00		
		Investigators	A/Prof David Simpson (MCIF)		
UoM x RMIT University x The Australian National University x The University of New South Wales x Deakin University	2020-2022	ARC	LE200100098	This project aims to establish a world leading facility to engineer quantum-grade diamond for precision sensing, secure communications, and desktop quantum computing applications. Direct outcomes from the facility include ultrasensitive magnetometers for magnetoencephalography, atomic microscopes for biomolecular	
		Funding	$600,000.00		
		Investigators	A/Prof David Simpson (CI); Prof Alastair Stacey (CI); Prof Steven Prawer (CI); Prof Lloyd		

			Hollenberg (CI); Dr Jean-Philippe Tetienne (CI); Prof Brant Gibson (CI); Prof Andrew Greentree (CI); Dr Philipp Reineck (CI); Dr Julius Orwa (CI); A/Prof Peter Reece (CI); Dr Liam McGuinness (CI)	imaging and novel sensing probes to interface with biology. The facility will seed the emerging diamond quantum industry in Australia and train the next generation of quantum engineers.	with industry partners Phasor Innovation and CSIRO. The project team and sensing technology were highlighted in Australia's National Quantum Strategy and the work outlined here is strongly aligned with the future strategic capability requirements of Defence and Pillar Two of the trilateral AUKUS agreement. The project will ensure Australia can maintain its global competitive advantage in diamond-based quantum technologies and will drive economic benefits through the training of new quantum engineers and the creation of start-up companies
UoM x RMIT University	2023	Name	Quantum Diamond Magnetometry for Navigation in	Diamond magnetometers offer high sensitivity and low measurement noise. This research demonstrates this by simulating external position fix	See above for how quantum engineering research can be used for warfare.

			GNSS Denied Environments	from the magnetic field measurements with a geographical data map using the probabilistic multiple hypotheses map matching filter with probabilistic data association for data mapping. This work is partially supported by the Australian Army Quantum Exploit funding.	
		Funding	This work was funded by the Department of Defence Australia through the Next Generation Technology Fund		
UoM (Air Force Office of Scientific Research)	2020-2022	Name	Towards Sub-Picotesla Quantum Diamond Magnetometers for Defence	The primary objective of this work was to engineer nitrogen-vacancy (NV) ensembles at varying concentrations levels in 111 diamond. Using the commercial-grade diamond CVD reactor at the University of Melbourne, the team	See above for how quantum engineering research can be used for warfare.

		Grant number	FA9550-21-1-0036	has engineered the first ultrapure 111 diamond layers in Australia. This represents the starting point for the NV incorporation study.	
		Researcher	David Simpson		

DefendTex

DefendTex is an Australian start-up weapons manufacturer equipping the Australian army and militaries internationally, manufacturing the D40 kamikaze drones which they collaborate on with Trusted Autonomous Systems (TAS). In 2020, the Defence Innovation Hub invested $2,089,000 for Grand Challenge to Counter Improvised Threats project with DefendTex for its Hydra – Multi Domain UxV for Anti-Submarine and Anti-Surface Warfare technology.

The Israeli military uses uncrewed and autonomous systems to, "enhance the already lethal traditional military technology and support their special operations forces." The Albanese government wrote that, "there is no widely agreed definition of autonomous weapons, and Defence exports a range of goods and technologies including for training and operations," to avoid confirming if Trusted Autonomous Systems and their associated Australian military projects were being exported.

DefendTex research with UoM has been related to military applications of electromagnetic modelling and autonomous systems toward the development of the D40 drone, which is an, "autonomous loitering grenade," with swarming capability. DefendTex offers engineering positions to work in a, "team of researchers at the University of Melbourne," for the, "development and integration of autonomy algorithms for swarming UAV platforms." This occurs on a co-location between DefendTex and the University of Melbourne.

Research projects

Research Partnerships	Project Dates	Quick facts		Summary	Connection to Defence Industry
UoM x RMIT x Flinders University x University of Adelaide x BAE Systems x DSTG x Tectonica (Rheinmetll Defence) x Simbiant – My Sky Technologies (SME)	2020-2023	ARC	Unknown	**Trusted Autonomous Systems Defence Cooperative Research Centre.** This works on Land Domain – Networked Autonomy which includes uncrewed ground vehicles (UGV) highly sophisticated navigation, mapping, vision, and safety systems. The TAGVIEW (Trusted Autonomous Ground Vehicles in Electronic Warfare) system would allow multiple UGVs to operate simultaneously to carry out mission objectives while identifying and evading potential threats.	Trusted Autonomous Systems is Australia's first Defence Cooperative Research Centre. DST Group and ADF utilise TAS research to support the following operational areas: operating in a contested chemical, biological, radiological and nuclear (CBRN) threat environments, agile command and control, and information warfare. .
		Funding	Unknown		
		Investigators	Unknown		

UoM x TAS	2020	Researchers	Chwen-Kai Liao; Chris Manzie; Airlie Chapman	A distributed algorithm for UAV-based communication networks using constrained extremum seeking.	The Trusted Search Project is now concluded. The final milestone showcased a multi-drone heterogenous swarm conducting a complex multi-task mission in a representative real-world environment. DefendTex partnered with RMIT University, the University of Melbourne, and the Defence Science and Technology Group (DSTG) to develop key algorithms (dynamic task planning, swarm formation and flocking control, terrain collision avoidance), key sensing technologies (rotating synthetic aperture radar) and platform technologies (including the Drone-40 family of USVs and subsystems). This project was approved by the board in August 2018
UoM	2019	Researchers	Chwen-Kai Liao; Christopher Manzie (ed.); Airlie Chapman (ed.); Tansu Alpcan	Output constrained extremum seeking: theory and application to UAV communication chains. Unmanned autonomous vehicles offer a solution to maintaining adaptive multi-hop communication paths when fixed infrastructure is not available, as may be the case in disaster recovery or in contested environments. Some of the potential challenges these networks face are changing environmental conditions, changing numbers of available agents and the need to avoid certain domains.	

UoM x RMIT University	2018	Key people	Glen Schafer (CEO); Dr Simon Ng (TAS Chief Engineer); Dr Kate Devitt (TAS Chief Scientist)	Trusted Scalable Search with Expendable Drones	and has delivered key technology demonstrations. A key platform from the project, the Drone 40, is now in operational use in defending Ukraine.

IBM

International Business Machines Corporation, also known as IBM, is a publicly traded American multinational technology corporation, and one of the world's largest and oldest computer and IT companies. IBM operates the central database of Israel's Population, Immigration, and Borders Authority, which includes information on both citizens and non-citizens within Israel and the occupied Palestinian territory. The database's main component is Israel's biometric population registry, which records people's ethnic and religious identity, IDF's "operational internet," a cloud-based computerized network. With similarities to the South African population registry deployed by the apartheid regime for racial sorting as a basis to implement racially based laws and segregation, the data in the Israeli registry is systematically used by Israel for the implementation of colonial policies.

DST Group and IBM Australia have a strategic alliance to conduct collaborative research in a range of high-end defence technologies, including cyber security and analytics, cognitive computing, and nanofluidic biosensors. In 2021, IBM Australia scored a $128 million contract for the second phase of the Department of Defence's enterprise resource planning (ERP) system overhaul. The contract follows on from an initial $95 million deal – which has since climbed to $112 million – for the design phase of tranche one. The new ERP system, which is anticipated to cost as much as $1 billion over eight years, is based on SAP's Defence Forces and Public Security solution and hosted on the S/4 HANA cloud platform.

The University of Melbourne became an initial member of the newly formed IBM Q Network in 2017. This is a collaboration of leading Fortune 500 companies, academic institutions and national research labs working directly with IBM to explore quantum applications for business and science. The IBM Q Network will foster a growing quantum computing ecosystem based on IBM's open-source quantum software and developer tools. As an IBM Q Network Hub, Unimelb researchers will work directly with IBM scientists and engineers to pioneer quantum computing solutions to real-world problems that can be solved faster or more efficiently with a quantum computer than with a classical computer. *See Phasor Innovation section for more information regarding militarisation of quantum engineering.*

Research projects

Research Partnerships	**Project Dates**	**Quick facts**		**Summary**	**Connection to Defence Industry**
UoM x University of NSW x University of Queensland […]	2011-2017	ARC	CE1101027	*ARC Centre of Excellence for Quantum Computation and Communication Technology.* The Centre for Quantum Computation and Communication Technology will coordinate a large team of Australian researchers in an intensive mission. Outcome = over 630 published papers (102 of these in Nature suite and Science journals), 46 granted patents, over 80 PhD completions and the delivery of nearly 550 invited talks.	Pilot program paved the way for the formal establishment of Australia's first quantum computing company, Silicon Quantum Computing Pty Ltd (SQC) and "similar ventures." By attaching a corporate structure to a Centre of Excellence, they aimed to capture the valuable IP and help bridge the gap to commercial outcomes in silicon quantum computing.
		Funding	$27,290,505.00		
		Investigators	Prof Michelle Simmons (CD); Mr Tony Raeside (COO); Prof Lloyd Hollenberg (CI); Prof Timothy Ralph (CI) […]		
UoM x La Trobe University x Edith	2013-2015	ARC	LE130100128	Helium and neon ion microscope for sub nanometer imaging and	The Royal Australian Air Force (RAAF) and the **University of Sydney** Nano
		Funding	$670,000.00		

Cowan University x The University of Sydney x Florey Neuroscience Institutes		Investigators	Prof Efstratios Skafidas (CI); Prof Steven Prawer (CI); Dr Christopher Pakes (CI); Prof Kamal Alameh (CI) […]	fabrication. The project's proposed instrument would add a new desperately needed capability to Australia's high resolution microscopy centre and nano fabrication facility and enable a wide range of users to image, measure, build and design complex nanostructures at the atomic level and upwards.	Institute today launched a scientific collaboration (Plan Jericho) to provide world-leading sensing technology for Australia's defence. Plan Jericho is RAAF's project to develop augmented intelligence capability to protect Australia from technologically sophisticated and rapidly changing threats. The Jericho Smart Sensing Laboratory will form a critical part of the plan's scientific infrastructure. These researchers will develop nanoscale devices that can assess physical, chemical, biological, acoustic, or electromagnetic environment. Sensors will be used on aircraft, satellites, vehicles and integrated into a sophisticated Combat Cloud – or Internet of Defence Things.
		ARC	LE200100049		

UoM x University of Sydney x University of NSW x Griffith University x University of Western Australia	2020-2021	Funding	$900,000.00	*Whopping Volta GPU Cluster – Transforming Artificial Intelligence Research.* This will establish a Volta graphical processing unit Cluster (wVGC) with the aim of smashing current impediments to compute-intensive AI research. The grant has been used to provide computing and AI facilities through the commercial **AWS cloud.** The cloud service was configured as a self-service platform and made available to all participating universities. It also enabled strengthening the existing industry partnerships with Rio Tinto, Qantas, Telstra, Alibaba, Microsoft, Google, IBM, & Facebook, & was instrumental in developing new industry links with Rakuten, Morse Micro, Roobuck, IQR, Department of Defence, Nokia, **Amazon**, & Optus.	Amazon in 2023 said it is planning to invest about $7.2 billion through 2037 in Israel, and launched its Amazon Web Services (AWS) data centres in the country. Amazon's cloud services in the region will allow the country's government to run applications and store data in data centres located in Israel. With the expansion, AWS will be available in 32 geographic regions, the company said, and will contribute about $13.9 billion to Israel's gross domestic product. At Unimelb, Research Computing Services provides preconfigured access to AWS's resources for researchers whose computational requirements cannot be met by the University's internal services (e.g. Melbourne Research Cloud or Spartan High-Performance Computing).
		Investigators	Prof Dacheng Tao (CI); Prof Branka Vucetic (CI); Prof Ramamohanarao Kotagiri (CI); Prof Eduardo Nebot (CI) […]		

UoM x Nanyang Technological x University, Singapore x The Australian National University	2022-2025	ARC	DP220101035	*Democratisation of Deep Learning: Neural Architecture Search at Low Cost.* The need to manually design Deep Learning-based Neural Networks (DNNs) limits their usage to AI experts and hinders the exploitation of their true potential more broadly, e.g., in farming, humanities. With many broad applications for DNN, this project has the potential to deliver significant economic, commercial, environmental, social, and cultural benefits to Australia and globally, including climate change and emergency events.	DSTG highlighted the rise of deep learning (AI technique). They noted that much of the progress in AI in the last decade has been driven by the ability to train deeper and deeper networks, thereby identifying more and more complex or abstract features. Data, computational speed, and new algorithms are the three main catalysts that have driven the increase deep learning research. The success of deep neural networks (particularly CNNs) for image classification led to a rapid explosion in research in the field of deep learning.
		Funding	$420,721.00		
		Investigators	Prof Saman Halgamuge (CI); Dr Elizabeth Ratnam (CI); Prof Ponnuthurai Suganthan (PI); Dr Julian de Hoog (CI)		
		Collaboration	[International] Singapore		
UoM x University of Queensland x	2023-2020	ARC	CE230100021	*The ARC Centre of Excellence in Quantum Biotechnology* aims to	In 2022, more than 90 delegates from academia, industry and government
		Funding	$35,753,654.00		

Flinders University x DSTG x Johns Hopkins University […]		Investigators	Prof Warwick Bowen (CD); Prof Halina; Rubinsztein-Dunlop (CI); Prof Michelle Coote (CI); A/Prof Elizabeth Hinde (CI); Prof Lloyd Hollenberg (CI) […]	develop paradigm-shifting quantum technologies to observe biological processes and transform our understanding of life. This will be the first national Centre worldwide at the convergence point of the quantum and bio-economies. New technologies range from portable brain imagers to super-fast single protein sensors. This will secure broad socioeconomic benefits, from national security to better treatments of disease, sustainable bioproduction of industrial and agricultural chemicals, and green energy technologies.	joined the latest Emerging Disruptive Technology Assessment Symposium (EDTAS) to explore the potential impacts of quantum computing technologies for Defence. Dr Jay Gambetta, from IBM Quantum in the US had participated. Australia's Chief Defence Scientist, Prof Tanya Monro, acknowledged the potential of quantum computing to fundamentally transform Defence capability and the national economy, noting that quantum computing has been designated as a national critical technology. While Australia is only 0.3% of the world's population, it is conducting more than 4% of the world's quantum research. Note that EDTAS series is an important mechanism, fully funded by the Next Generation Technologies Fund, that provides a mechanism by
		Collaboration	[INTERNATIONAL] Austria; Canada; England; France; Germany; Japan; Netherlands; Scotland; US		

					which Defence can engage the national S&T enterprise to develop a comprehensive and evidence-based understanding of emerging and potentially disruptive technologies.

MOG Labs

MOG Laboratory collaborates with Israeli labs, us army corps, Lockheed Martin, commercialisation of state-of the-art electronics and lasers for basic and applied research, with a particular emphasis on quantum science. The company sells and provides variable wavelength lasers, laser electronics, optical amplifiers, radiofrequency synthesizers, laser wavelength measurement devices and other such high-performance laser technologies essential for research organizations involved with quantum technologies.

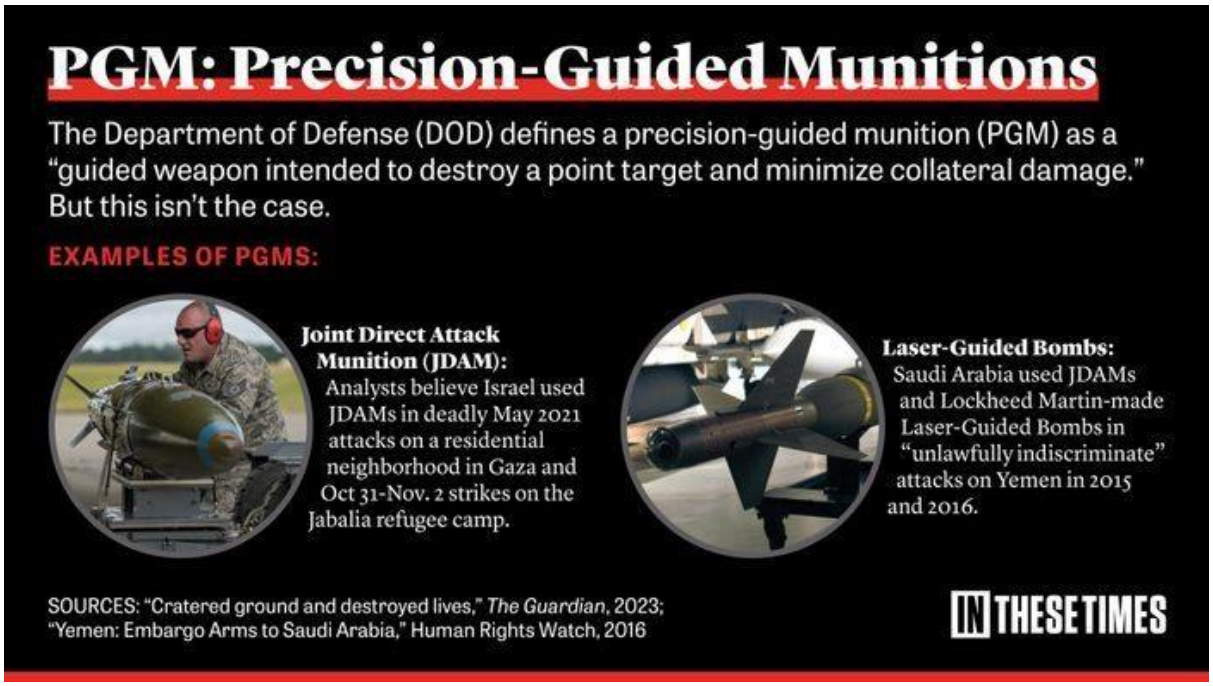
The company's connection to Israel can be seen through their facility located in LAS Photonics. LAS Photonics is a representative company in the field of Lasers and Electro-Optics specialized in promoting and introducing new Photonic Technologies to Israel's Defence, Aerospace, Industrial, Medical and Scientific sectors. They are working with photonics manufacturers around the world, including in Australia.

Directed Energy systems, particularly High Energy Laser (HEL), are primarily developed by RAFAEL. This technology is used in Israel's Iron Beam , a 100kW class High Energy Laser Weapon System (HELWS) designed to intercept threats such as RAM and UAVs from a range of distances.

This is particularly ironic, as the RAM guided missile weapon system is a key weapon in Israel's arsenal for genocide. The threat of missiles directed at Israel was heavily emphasised, for example in the Hezbollah attack on the Iron Dome. Meanwhile, PGMs—which include any guided missile designed to hit an extremely precise target—have been Israel's weapon of choice in its attack on the recent Gaza bombardment. Satellite-guided bombs (a type of PGM) of between 1,000 and 2,000 pounds made up about 90% of the weapons the Israeli military used in the first two weeks after October 7.

While PGM's advanced targeting is billed as a way to avoid civilian harm, they have been linked to many strikes by Israel and other U.S. allies on densely populated areas, including homes in central Gaza and the Jabalia refugee camp. Particularly notable is Israel's system of defensive mobile batteries: the Iron Beam. The major limitation of this weapon is that it is extremely expensive; reported costs for a single interceptor,

called Tamir, range from $40,000 to more than double that. This is the major driver for Israel's deployment of laser air defences, and for increased focus on researching laser systems. See below for further information on the use of PGM's in the genocide of the Palestinian people.


PGM: Precision-Guided Munitions
The Department of Defense (DOD) defines a precision-guided munition (PGM) as a "guided weapon intended to destroy a point target and minimize collateral damage." But this isn't the case.
EXAMPLES OF PGMS:
Joint Direct Attack Munition (JDAM):
Analysts believe Israel used JDAMs in deadly May 2021 attacks on a residential neighborhood in Gaza and Oct 31-Nov. 2 strikes on the Jabalia refugee camp.
Laser-Guided Bombs:
Saudi Arabia used JDAMs and Lockheed Martin-made Laser-Guided Bombs in "unlawfully indiscriminate" attacks on Yemen in 2015 and 2016.
SOURCES: "Cratered ground and destroyed lives," The Guardian, 2023; "Yemen: Embargo Arms to Saudi Arabia," Human Rights Watch, 2016
IN THESE TIMES

The research conducted at MOGLabs designs high-performance laser technology for researchers in quantum science and technology. The aim of the research is to solve the problem where researchers need sophisticated instrumentation but often lack the time or skill to build it. Note that the laboratory was **founded** by Unimelb researchers in 2007, is based in Carlton, and has sales offices in the US and Germany. It supplies its products to research labs and is expected to grow in line with the increasing research market for quantum engineering and into diverse sectors, including defence and aerospace. Unimelb physics students are using MOG Labs technologies in their undergraduate courses. More information here.

MOGLabs has been awarded more than $A1.2 million over three Australian Research Council (ARC) Linkage Project grants to further develop and commercialise its laser technology. It is also a participating member of the ARC Centre of Excellence for Engineered Quantum Systems (EQuS), which was launched in 2017 with $A31.9 million funding over 7 years. MOGLabs is an industry partner with the University of Melbourne in two Innovation Connections grants, part of the Australian Government's

Entrepreneurs' Programme. Funding support was also assisted by Australian Government Innovation Connections grants, but the program closed on 9 May 2023.

Research projects involved with MOGLabs are listed below:

- Daniel J. Thompson and Robert E. Scholten. Narrow linewidth tunable external cavity diode laser using wide bandwidth filter. *Review of Scientific Instruments*, 83(2):–, 2012.
- JD White and RE Scholten, Compact diffraction grating laser wavemeter with sub-picometer accuracy and picowatt sensitivity using a webcam imaging sensor, *Review of Scientific Instruments*, 83 113104 (2012). doi: 10.1063/1.4765744
- Hawthorn CJ et al (2001) Littrow configuration tunable external cavity diode laser with fixed direction output beam. Review of Scientific Instruments 72(12): 4477–4479. doi: 10.1063/1.1419217
- P. J. Fox, R. E. Scholten, M. R. Walkiewicz, and R. E. Drullinger. A reliable, compact, and low-cost Michelson wavemeter for laser wavelength measurement. Am. J. Phys., 67(7):624–630, 1999.

Research projects

Research Partnerships	**Project Dates**	**Quick facts**		**Summary**	**Connection to Defence Industry**
UoM x The University of Sydney x Monash University x The University of Adelaide	2013-2016	ARC	LP130100857	Foundation technology for quantum measurement, sensing and computing. This project will advance quantum control of cold ions, atoms and diamond colour centres for application of quantum science to high-tech problems, from ion-based quantum computing to diamond-based quantum imaging inside living cells.	Related to the Australian Defence Force, the latest Emerging Disruptive Technology Assessment Symposium (EDTAS) to explore the potential impacts of quantum computing technologies for Defence (DSTG). Information regarding the Quantum Technology Defence Imperative can be found here. Also note that Israel built a quantum computer relying on ion traps.
		Funding	$440,881.00		
		Investigators	Prof Robert Scholten (CI); Prof Michael Biercuk (CI); Prof Lloyd Hollenberg (CI); A/Prof David Simpson (CI); Prof Kristian Helmerson (CI); Dr Lincoln Turner (CI); Dr Russell Anderson (CI); Prof Andre Luiten (CI); Dr Robyn Starr (PI)		
		ARC	LP150101188		

UoM x The Australian National University x The University of Sydney x The University of Adelaide		Funding	$365,114.00	*Optical technology for quantum science.* This project has developed and commercialised laser technology to support quantum science and technology in Australia and internationally. Commercial outcomes include new Australian-made and exported products for (1) high-bandwidth stabilisation of lasers to quantum transitions (2) high-power fibre amplifiers at critical quantum wavelengths and (3) a new type of ultranarrow tunable laser at 1560nm. The project was critical in higher-degree research training of several PhD and MSc students.	See information above regarding HEL technologies.
		Investigators	Prof Robert Scholten (CI); A/Prof Nicholas Robins (CI); Prof Michael Biercuk (CI); Prof Elanor Huntington (CI); Dr Benjamin Sparkes (CI); Prof Benjamin Buchler (CI); Dr Robyn Starr (PI)		
UoM x The Australian National	2019-2022	ARC	LP180100332	High-brightness wavelength tuneable lasers for quantum	See information above regarding HEL technologies.
		Funding	$452,984.00		

University x Monash University x RMIT University		Investigators	Prof Robert Scholten (CI); Prof Chennupati Jagadish (CI); Prof Arnan Mitchell (CI); Prof Hark Hoe Tan (CI); Dr Fouad Karouta (CI); A/Prof Nicholas Robins (CI); Dr Lincoln Turner (CI); Dr Robyn Starr (PI)	science. This project aimed to establish the capability to manufacture application-specific semiconductor lasers but was not realised due to storm damage at ANU facility and covid-related problems. However, the work with RMIT led to an unexpected advance: development of a high-bandwidth intracavity modulator for external cavity diode lasers based on the MOGLabs-proprietary cateye laser. That modulator allows unprecedented control of laser frequency, to allow improved manipulation of quantum computing qubits, and improved atomic clock frequency stability.	
UoM x Monash University x The	2023-2026	ARC Funding	LP200100082 $470,975.00	*Agile synthesizers for quantum computing, simulation and sensing*.	

University of Sydney x RMIT University		Investigators	Dr Lincoln Turner (CI); Prof Robert Scholten (CI); Prof Kristian Helmerson (CI); Dr Cornelius Hempel (CI); Dr Alexander Wood (CI); Dr Jean-Philippe Tetienne (CI); Dr Robyn Starr (PI)	The project aims to develop breakthrough technology for generating the complex radio and microwave pulses that underpin the revolution in quantum computing and quantum sensing. Enhanced quantum sensors will benefit medical microimaging, mineral exploration and magnetic anomaly detection for defence. Existing quantum technologies are limited by the capabilities of the classical hardware that controls the quantum systems, particularly in relation to size, weight, power requirements and cost. The goal is to provide devices specifically designed for quantum technology - devices that are compact and power-efficient, to enable translation of laboratory	See Phasor Innovation for a summary of how quantum engineering research is being used for warfare.

				quantum prototypes to real-world applications.	

QinetiQ

QinetiQ Australia is a subsidiary of British arms company QinetiQ. It delivers training support to the Australian Defence Force on platforms such as the F-35.

Australia's Defence has awarded a $12.9 million contract to QinetiQ Australia to co-develop and manufacture a high energy defensive laser system prototype capable of deployment in a wide range of operational environments. This involves the Directorate General Technical Airworthiness – Australia Defence Force (DGTA-ADF), with rolling extensions for a term of up to 15 years. The aim is to instill greater collaboration between the DGTA-ADF, QinetiQ Australia and the Defence Science and Technology Group (DST Group) to ensure the ADF remains at the forefront of Aircraft Structural Integrity (ASI) engineering and management services. As part of the contract, QinetiQ Australia will deliver a range of ASI expertise including structural integrity management, airframe life extension, design of repairs and modifications, stress and fatigue analysis, software development and non-destructive testing.

The above award follows from a $5.4 million investment by the Morrison Government (October 2021) to develop an innovative, deployable micro-grid that will help address an increase in the demand for power in the modern battlefield. In 2018-2019, QinetiQ was also funded $350,000 for the development of an alternative electrical micro-grid solution for deployed forces. This technology seeks to enhance the efficiency and effectiveness of in-field power generation systems and could be adapted to other power systems such as those on vehicles, ships, and aircraft (see page 62).

At Unimelb, QinetiQ Australia is delivering engineering and technical services at the University's Creator Space. The space will support Melbourne School of Engineering students across disciplines from mechanical and electrical engineering to IT and biomedical engineering. It aims to combine equipment including 3D printers, laser cutters, CNC machines, electronics manufacturing, and power tools, with on-site experts to guide the use of all equipment.

Research projects

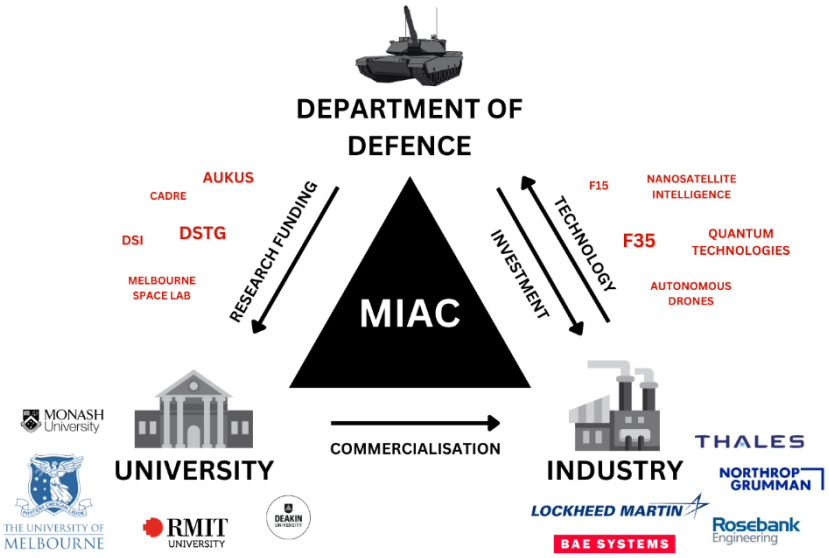
Research Partnerships	**Project Dates**	**Quick facts**		**Summary**	**Connection to Defence Industry**
UoM x Defence Innovation Hub	2020-2022	Name	Deployable Adaptive Smart Grid Phase 2 Studies	This 21-month project is funded by QinetiQ Australia and the Defence Innovation Hub. The project investigates the benefits and most suitable control strategies of smart grid technologies to help Defence improve the reliability, fuel efficiency, and logistical aspects associated with the electrical infrastructure of their deployed forces. Technologies involved include Diesel generators, batteries, microgrids, and Smart Grids.	The Defence Innovation Hub announced awarded QinetiQ Australia with nearly $5 million over two years for the second phase of development for the Deployable Adaptive Smart Grid (DASG). DASG will provide the energy storage systems, electrical distribution infrastructure and centralised control necessary to improve the efficiency, resilience, and power quality of the ADF's deployed three phase power systems.
		Researchers	Prof Luis (Nando) Ochoa; Dr Maria Vrakopoulou; Dr Bigi Varghese Philip; Dr Dillon Jaglal		
		Access	Unknown		
UoM	2018	Supervisor	Dr Arlie Chapman	*Autonomous vehicle fleet positioning: Coverage Assurances*	Unmanned Ground Vehicles (UGV) are technologies used in the ADF. Titan, for instance, is a large UGV

		Group members	Yun Fang, Christopher Harrison, Shuo Liu, Zhaoxi Yi	*under failures and perturbations [MASTERS PROJECT].* This project involves designing a coverage algorithm, implementing, and testing the algorithm on a fleet of ground vehicles and exploring performance assurances accounting for individual vehicle failures, vehicle motion characteristics and environmental perturbations. This project is sponsored by QinetiQ.	that provides safety and support for small, dismounted military operations, developed by QinetiQ and Milrem Robotics. Robotics and autonomous systems can be configured for specific tasks such as IED defeat, CBRN/hazmat identification, reconnaissance, combat engineering support and SWAT/MP unit assistance. Further, QinetiQ UGV's have been in active duty for over 20 years supporting critical missions worldwide. QinetiQ's robots are widely deployed for improvised explosive device (IED) and explosive ordnance disposal (EOD), reconnaissance, communications, CBRN (Chemical, Biological,

					Radiological, Nuclear), HAZMAT, security, heavy lift, defense and rescue missions.

Government-funded programs

Without full disclosure of the nature of Unimelb's ties to weapons and defence companies (which the University has refused to provide), it is difficult to map the full extent of the funding stream towards defence research. To understand this incredibly complex web, it is worthwhile to visualise the network as below:



The above maps the Military Industrial Academic Complex (MIAC). This represents the symbiotic relationship between government, defence industry, and academia, which manifest in collaborations on military-related projects. The web can be understood as follows: the national interest for increased hypermilitarisation of research and development (R&D) comes from the Australian Government (see: AUKUS below). Australian universities are viewed as a "military asset," and their purpose is to produce a future workforce for defence and provide the research and development (R&D) required to underpin Australian military advantage Government-funded programs, such as the Defence Science and Technology Institute (DSTG) act as the link between state government and universities. This networks ultimately bring together a fusion of the aims of both universities and state governments to grow their share of government and industry defence funding, and the government aims to expand partnerships between the groups.

Below is a brief summary of key government programs that fund university research for the purposes of military innovation and enhancement. This strengthens the triangular relationship between defence, academia, and the weapons manufacturers themselves, as seen in the diagram above. The aim of this summary is only to orient and alert the reader to the web of defence ties the university has, with the understanding that these partnerships are deliberately complicated and designed to confuse and obfuscate.

Defence Science Technology Group (DST or DSTG)

The Defence Science and Technology Group is an arm of the Defence Department. DSTG is the second largest publicly funded research group in Australia with an annual budget of over $400M, to allocate defence funding and coordinate research at universities. Unfortunately, defence department funding within our public universities is for the most part classified.

The following are a few programs that have publicly acknowledged the DSTG as a funding partner:

Melbourne Defence Enterprise

In 2016, the University of Melbourne and DSTG established a partnership named the Melbourne Defence Enterprise (MDE). The MDE acts with an entrepreneurial role to exploit the university's facilities, academics, research staff and students aimed at procuring and facilitating defence (weapons) research in the name of addressing challenges facing so-called Australia's national security. This is accomplished by facilitating connections between industry, government, and other research institutions (see MIAC) through various portfolios made possible by the extension of defence funding and the growing research bases of international weapons company's in Naarm. The following are just a few:

- HumanPRIMED: Through world-leading human performance research facilities, HumanPRIMED addresses complex problems in human performance by leveraging the perspectives of technology and health professionals focused on understanding the Defence environment.

- MIDAS Laboratory (Melbourne Informational, Decision and Autonomous Systems): MIDAS Laboratory is at the forefront of autonomous systems for defence and civilian uses. It produces technological advances in automation, control systems, analytics, machine learning, and system optimisation for robotics and swarms of networked distributed autonomous systems, including swarm drone technology used against the Palestinian people. In May 2021, for example, Israel used Elbit Systems' Legion-X drone swarm (an autonomous networked combat solution) in combat aimed at locating and destroying targets in cluttered, built-up areas.

- AI-led platforms (targeting social media data for military intelligence): This platform is used by the DSTG (defence department) and various researchers, particularly in the United States, to extract high-quality social media data in real time to help defence analysts monitor and respond to fast-moving events.

Defence Science Institute (DSI)

The Defence Science Institute (DSI) is a professional service that provides stakeholders advice on the defence (weapons) research and development, creating research networks for industry, the Defence Science and Technology Group and Victorian Universities going back to 2010. It is funded as a joint university and Victorian government, and Defence department program, DSI offers seed funding for defence research for collaborative initiatives crossing over government and private sectors.

DSI works with the DSTG (defence department), US funding agencies, weapons companies such as Lockheed Martin and Tectonica, and over 200 small-medium-enterprise (weapons manufacturers) including international primes.

Unimelb staff who are also executives of DSI include:

- Len Sciacca: head of the Melbourne Defence Enterprise is a DSI liason manager.
- Liz Sonenburg: The Pro Vice-Chancellor (Systems Innovation) of research enterprise is also a DSI Board Member.
- Adrian Pearse: A professor of computing, a researcher undertaking DSI programs at Unimelb as well as the Director of DSI.

- Toby Murray: An associate professor of computing and information systems, a researcher and the deputy director of DSI.

Defence Innovation Hub (DIH)

The Defence Innovation Hub, launched in December 2016, launched in December 2016, enables Defence, industry, and research institutions to collaborate on innovative technologies that can be delivered as advanced capabilities for Defence. By 2020, the Defence Innovation Hub had signed 148 contracts with Australian businesses and research institutions, invested over $240 million in innovative technology, and it will fund over $800 million in further investment until 2030.

The Defence Innovation Hub program procures innovative technology for Defence, where Defence provides the capital needed for so-called Australian industry to further research and development. The aim of the program is to streamline the process for industry to make it easier for start-ups and innovative small businesses to do business with Defence.

The Defence Innovation Hub accepts proposals that are ready to enter the engineering and development stages of the innovation process, from concept exploration and technology demonstration to prototyping and integrated capability demonstration and evaluation. Three DIH projects that have been completed include:

- CRCX helmet project: The University's Department of Biomedical Engineering will undertake a key role in the CRCX helmet project by providing necessary analytical and modeling outcomes aimed at optimising helmet designs, which will materially reduce injury to the human brain from blast effects.
- Deployable Adaptive Smart Grid (DASG): This was funded by weapons manufacturer QinetiQ Australia and the Defence Innovation Hub. It produced the initial studies to determine the potential benefits that smart grid technologies could bring to Defence in terms of reliability, fuel consumption, and deployment size and weight.
- Deployable Adaptive Smart Grid (DASG) 2: This was funded by QinetiQ Australia and the Defence Innovation Hub. The project investigates the benefits and most suitable control strategies of smart grid technologies to help Defence

improve the reliability, fuel efficiency, and logistical aspects associated with the electrical infrastructure of their deployed forces.

CADRE-OCE

The Centre for Advanced Defence Research and Enterprise (CADRE) is a nationally coordinated initiative that drives academic research toward biosensors and robot swarm systems to combat chemical, biological, radiological and nuclear environment (CBRN) threats.

The Australian Department of Defence gave $4.25M over 5 years to CADRE, with the possibility of extending, and links to a DST-led initiative called the OCE STaR Shot. It is located at the University of Melbourne, in close partnership with the University of Adelaide, Queensland University of Technology and the University of New South Wales. The program is working on the Active Collaborative CBRN Environments Sense and Sense-making System (ACCESSS), a network of sensors for military platforms and infrastructure that autonomously monitors the environment for CBRN threats, and the Human Integrated Sensor System (HISS), which similarly, "treats the human as a sensor."

The initiative brings together defence, academia, and industry on Unimelb's campus for the CADRE-OCE Academy, advertised with a range of educational offers, including industry PhD programs, PhD programs, Design for Defence Program and an Entrepreneurship and Commercialisation Program.

AUKUS

AUKUS is a three-way security pact between Australia, the UK and the US. The Albanese Labour government created the Advanced Strategic Research Agency (ASRA) to fund research towards military technologies to further the defence interests of Australia and its allies, described as, "a premier avenue for linking Australian industry (including SMEs) and universities with our AUKUS partners." Phasor Innovation and the University of Melbourne work together on quantum technologies. This includes Quantum Diamond Sensors, a new form of magnet geometry for GPS denied environments. This research and development has been highlighted in Australia's National Quantum Strategy and aligns with the future strategic capability requirements of Defence and Pillar Two of the trilateral AUKUS agreement.

Melbourne Space Lab

The Melbourne Space Laboratory (MSL) is a lab at the University of Melbourne that works on technological solutions for nanosatellites. Specifically, MSL develops a thermal management and control system as part of space-based military intelligence, surveillance and reconnaissance.

Space-base intelligence gathering in Palestine is conducted in Australia at the Joint Defence Facility Pine Gap, which is a US military base sharing raw data with Israel; located near Alice Springs. Leonardo Australia, a weapons manufacturer selling directly to the Israeli military, and the University of Melbourne signed a Memorandum of Understanding, beginning a project to design and integrate MSL space technologies into Leonardo's products, such as the infrared detectors and hyperspectral sensors.

CSIRO Defence Program

CSIRO is a renowned national science agency that also runs a defence program, where scientists work alongside academia, such as University of Melbourne, to develop military technologies, from an $8.6M contract to create respirators for soldiers to developing a global quantum secure network.

These include the Cross Domain Desktop Compositor (CDDC), a security system for computer networks created through a collaboration between DSTG, CSIRO and Associate Professor Toby Murray of the University of Melbourne.

In response to Unimelb claims

1. According to the The University of Melbourne Funding Agreement 2024: why was $9,850,500 awarded for the university from The Education Minister, for the period of 2024, to financially reward industry partnerships and collaborations with STEM students in the National Priorities and Industry Linkage Fund (NPILF) program?

   The document makes clear; This is for joint research, internships, practicums and work-integrated learning goals. “Rewarding providers for the development of partnerships and collaborations with industry.” This is almost 10 million of taxpayers money lining the pockets of weapons companies.

2. According to the 2024 Early Career Researcher Grants Scheme Guidelines published by Unimelb: *“The ECR grant holder must ensure that the research is conducted in accordance with University policy, including compliance with the Australian Code for the Responsible Conduct of Research (2018) and policies on human research ethics, animal experimentation ethics, requirements of the Office of Gene Technology Regulator, health and safety and intellectual property. No project may proceed unless the appropriate ethical or other required clearances have been obtained.”*

   In this, there is an intentional undermining of what the policies on human research involve. According to the National Statement on ethical conduct in human research 2023, the risk of harm to participants and non-participants by the creation of weapons and or defence technology would deem all the following research unethical. Why is there an intentional mismanagement of ethical research being conducted at the University of Melbourne? Could this disregard for human ethics, including the following documentation of partnerships with 13 weapons companies who are currently supplying Israel weapons, mean that the University of Melbourne, and its complicit staff, be indicted for the crime of aiding and abetting genocide?

3. If Unimelb is not working on weapons, why did Catriona Jackson, the Chief Executive of Universities Australia submit in the UNIVERSITIES AUSTRALIA | 2023-24 PRE-BUDGET SUBMISSION (January 2023) that, “Direct funding of R&D

offers a mechanism for better aligned incentives for university-industry collaboration, from small to medium enterprises to large business. Direct funding of R&D also provide flexibility in policy objectives and indicates that investment is well targeted and guarantees additionality."

In reality, direct funding will decrease transparency, as well as add secrecy, like we have seen with the classification of weapons research in the US Universities.

4. If Unimelb is not working on weapons for sale to private buyers like Israel, then why did The University spend $11,200 on consultancy in 2023 with AADI Defence? A company that helps streamline a commercialised weaponry product?

5. If the university and its weapons company partners are not research, developing and exporting weapon, to buyers like Israel, why did the university make a Submission in response to the Exposure Draft of The Defence Trade Controls Amendment Bill 2023, on the 17th of November, one month into the Genocide of Palestinians, with the following statements;

'The University's assessment, judging from the framing of the current Bill, is that the new law will significantly increase the number of permit applications submitted to DEC. We anticipate that a large volume of new permits may be required each year for the University of Melbourne's activity alone, especially given the extensive availability of some DSGL capabilities to University personnel and affiliates who will likely be considered foreign persons.'

'Currently the Foreign Country List contains 25 countries only and it does not include some members of Australia's regional partnerships. This presents an opportunity, and the University supports options to expand the scope of the exemption to cover some of Australia's like-minded nations with which the Australian higher education sector collaborates on dual use or defence research. This could potentially be implemented through an additional list of exemptions that consider Australia's foreign policy and strategic interest.'

'Under the existing regulations, researchers and research organisations have not been able to rely on the basic research exemption when undertaking research activity, even when intended for publication. As such, Export Controls may apply to

any potentially dual use research, even where it is intended for sharing in the public domain. While controlling transfer of such technology through permits arguably has no significant strategic implications to the national interest, it dilutes the focus of both universities and regulators, who must screen, assess and process permits for this scenario.'

6. If the University and its weapons company partners are not invested in conducting research and exporting weapons with weapons companies to foreign buyers, like Israel. Why did the university feel any need to make a second submission on 1st of February 2024, four months into the genocide of Palestinians that asked for exemptions?

   In the Submission to the Senate Foreign Affairs, Defence and Trade Legislation, the university stressed that in prior consultations and submissions they are aware that controls will affect their research collaborations domestically and internationally. In an effort to reduce the supposed risk to the university recommendations were mostly asking for research exemptions and argued that:

   "Such impacts would be broader than the actual regulated areas. The regulatory burden will not only be felt by Defence, but also the research sector and the defence industry. This disincentive for defence innovation can be significant and immediate, including on collaborations solely with FCL countries. While collaborations will become easier within AUKUS countries under the Bill, we anticipate that researchers may see reduced collaboration with other countries (including FCL countries) and in lower-risk fields of research (including those that are not regulated under Australia's export control regime)."

7. If the University and its weapons companies are not selling weapons via export, why are some of the university of Melbourne research outputs for sale on the Defence Export Catalogue 2024?

Conclusion

Unimelb for Palestine demands that the University of Melbourne:

1. Immediately divests and cut ties with all weapons manufacturer, starting with Lockheed Martin, Boeing, BAE Systems, and Rosebank Engineering.
2. Divests from all companies complicit in the genocide in Gaza and in the Israeli occupation in Palestine, and abides by the Boycott, Divest, and Sanction (BDS) list, starting with Amazon.
3. Provides full disclosure and transparency of the nature of research being conducted under the umbrella of weapons manufacturers funds and grants.
4. Stops accepting blood money from war mongers and the death industry.
5. Takes a moral and ethical stance against the ongoing genocide in Gaza and condemns the Israeli apartheid regime's ongoing occupation of Palestine.
6. Condemns the Zionist regime's systematic destruction of every University in Gaza and the targeted killing of Palestinian academics and students.

A refusal to do so is antithetical to the University's anti-racism commitment to creating a safe and inclusive environment for all students, including Palestinians. We will not stop until the University cuts ties with weapons manufacturers aiding and abetting the genocide. We will not stop until the University divests from the Israeli regime and ceases to profit from the oppression of the Palestinian people.